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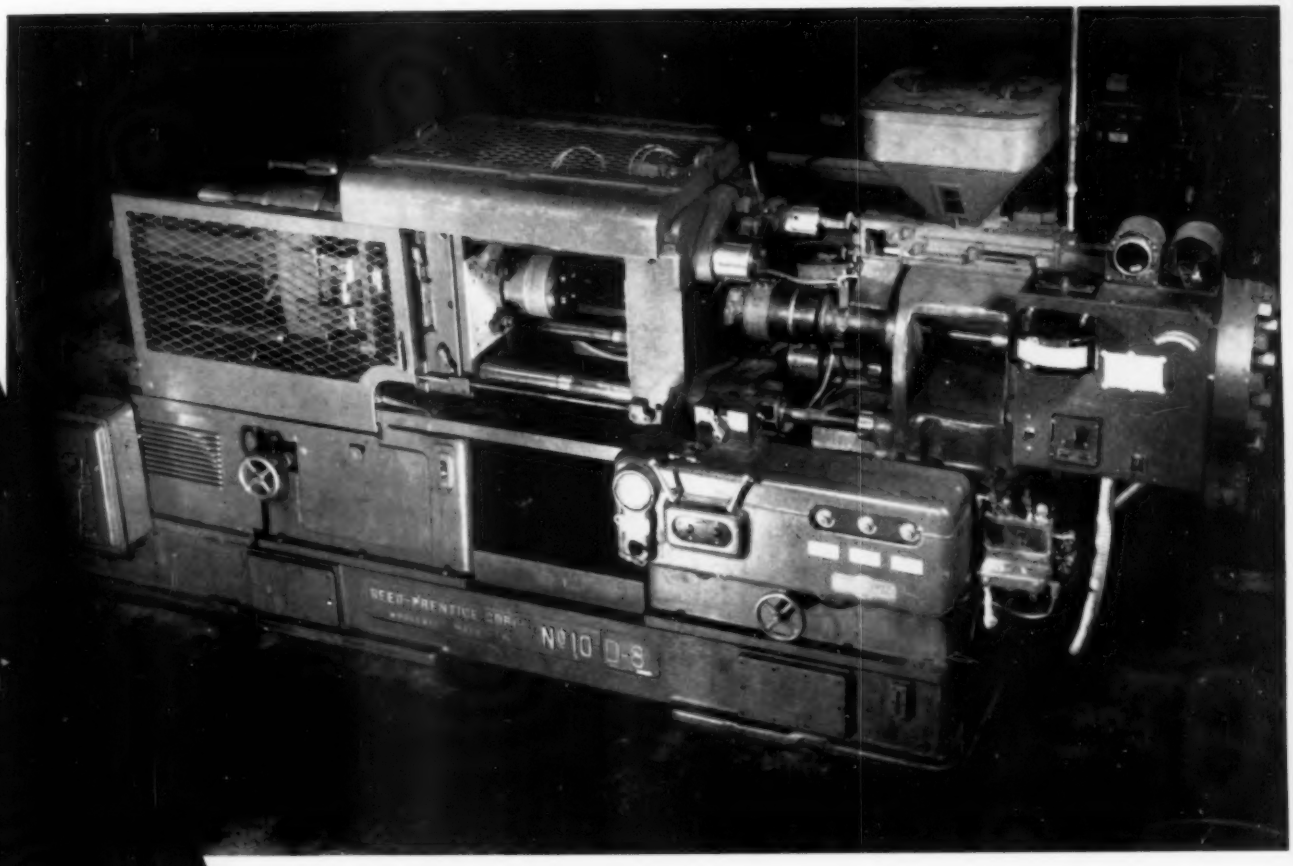

Eight ounce Reed-Prentice injection molding machine with conversion unit for the jet molding of thermosetting materials.

PUBLISHED BY THE SOCIETY OF PLASTICS ENGINEERS, INC.

What's New?

Materials

ACRYLICS

Increased production of acrylic plastic is meeting heavy military demands while still allowing civilian orders to be filled in reasonable volume, it was reported today by Rohm & Haas Company, leading manufacturer of acrylic sheet and molding powders.

Dr. D. S. Frederick, vice-president, said, however, that the supply of the company's Plexiglas acrylic plastic available for non-military applications is diminishing despite significant increases in production facilities provided by Rohm & Haas over the past two years. Further increases are scheduled, it was pointed out, but whether these materialize depends on availability of raw materials and on such restrictions as may be placed on the sale or use of intermediates and finished plastics.

FIBERTHIN

A new waterproof fabric, made of nylon fiber and plastic, has been developed by United States Rubber Company for use in raincoats, tarpaulins and many other products.

The fabric, called Fiberthin, has exceptionally high strength and tear resistance. Scientists say it has greater strength for its weight than any other fabric ever developed. It weighs only five ounces a square yard and has a tear strength of 15 to 22 pounds with a tensile strength of 150 to 180 pounds. In addition to being waterproof, the new fabric is mildew and flame-resistant, oil, acid and alkali resistant.

It consists of a base fabric, developed exclusively for coating, which is made of specially woven nylon fibers and then coated on both sides with a plastic compound.

Fiberthin is now being produced by the rubber company for airplane wing covers, aerodynamic air seals, protective covers for boats and equipage and other applications requiring light weight, high tear and tensile strength.

It is also considered practical for exposure suits, flying suits, tents, raincoats, ponchos, tarpaulins, movable shelters, engine, gun and propeller and Navy bunk covers.

Wing covers now being made for the B-36 bomber from conventional materials weigh 800 pounds whereas those that will be made from Fiberthin will be 30 percent stronger and will weigh only 300 pounds.

ANTIMONY OXIDE

Tucked away in the mountains of northern Idaho, 100 air miles from Boise is the relatively isolated community of Stibnite sixty miles away from the nearest railway at Cascade. But there are thousands of such settlements hidden in the back lands of our expansive country, settlements that are to the traveller just tiny dots on a road map! Yet Stibnite is different because of its tremendous importance.

Stibnite as a name is the mineralogical term for antimony. Geographically it marks the location of the Yellow Pine mine, the largest single antimony mine in the world that produces 95 percent of all the antimony used in the United States—antimony for ammunition, non-friction bearings, storage batteries and hundreds of other strategic uses.

Stibnite, Idaho, is the source of Elk Brand Antimony Oxide that has come into high favor in many industries, including paint manufacturing, rubber, ceramics, drugs, pharmaceuticals, glass, plastics, textiles, canvas and surface coatings.

While the major use characteristic of Elk Brand Antimony Oxide is the rendering of textiles, paints, plastics, etc. flame proof it has other important applications. It is used in the preparation of tartar emetic for drugs and pharmaceuticals, an opacifier for cast iron porcelain enamels, as well as a decolorizing and refining agent for glass.

Whittaker, Clark & Daniels, 260 West Broadway, New York, N. Y. has the sales right east of the Mississippi, including St. Louis.

Equipment

300 OZ. MACHINE

The Watson-Stillman Co. announces that the Ideal Plastics Corporation at Hollis, Long Island has installed two 300 ounce molding machines. The addition of these machines to the 71 molding machines of varying capacities, already operating at Ideal, establishes the company's molding potential amongst the largest in the country.

MAGNETS

At the Bound Brook, N. J. plant of Bakelite Division, Union Carbide and Carbon Corporation, Eriez Plate Type Permanent Magnets are installed to prevent contamination of phenolic molding compounds.

The 6 inch stainless steel-faced magnets are inserted in inclined loading lines through which the colorful, finely powdered compounds flow before they are packaged in drums. It is important that no tramp iron contaminate the finished product.

The powder flows at a rate of 500-1200 lbs. per hour, with depth of material about one inch. Performance has been satisfactory.

Eriez Permanent (non-electric) Separators are used throughout the chemical processing and other industries to remove tramp iron from materials. In so doing three main objectives are realized: (1) Damage to expensive machinery, consequent downtime and delay are avoided; (2) Fire hazard is diminished; and (3) Contamination of product is prevented.

Eriez stainless steel magnets in Bakelite's plant are installed in pipelines which carry powdered plastic molding material.

BLANK CUTTER

The Accurate Steel Rule Cutting Die method of blanking out plastics to any regular or irregular flat shape or size, is proving very satisfactory. During the past few years, the number of manufacturers using this method, has rapidly multiplied.

Accurate Steel Rule Cutting Dies are suitable for die cutting all types of flexible plastics. Thin rigid plastics can also be satisfactorily cut in most instances. Rigid thermoplastics in the heavier guages can be cut when pre-heated.

We list herewith a few of the many plastics that have been cut with Accurate Steel Rule Dies: Vinyl, Vinylite, Celluloid, Acetate, Plexiglass, Lucite, Koreseal, Rubber, Corprene, Velon, Fabricoid, and Pliofilm.

The advantage of this method of Die Cutting lies in the very low cost of this type of die, as well as the fact that all dies are shipped the same day that the order is received.

This cutting or blanking can be done on almost any type of power press. If you yourself do not have any presses or Die Cutting machinery, one of our associated companies will be glad to manufacture your parts for you by this method, at so much per thousand pieces. Very rapid delivery is also available on this die cutting service.

HIGH FINISH

Fast, economical and uniform high luster finishes on all types of metal parts and tools are now possible by the use of a new, low-cost, bench model wet-blaster called the CRO-HONE, JR., manufactured by the Cro-Plate Company, Inc. of Hartford, Conn.

Designed to offer a surgically clean base for plating or painting and remove completely all foreign and amorphous substance from metal surfaces, the CRO-HONE, JR. uses fine abrasive suspended in a water carrier which is forced against large or small metal parts by air pressure through a siphon jet gun.

Of full stainless steel construction, the unit has no moving parts or circulating pumps. As a result, maintenance requirements are extremely low. Also, the small, compact construction of the unit, coupled with low abrasive replacement cost ideally suit it to use in tool and die shops, electroplating shops, methods engineering set-ups, auto repair shops, dental labs and college and university labs.

In operation, the metal parts to be finished are inserted through the front window door. All openings are fitted with splash-proof guards which allow neat, leakage-free installation. All controls are located within easy reach on the side of the cabinet and the large, clear-view window enables the operator to watch progress of the work. A blower clears away the abrasive splash so that vision is not obscured. The work is held in one hand, the easily manipulated gun in the other.

A removable filter makes cleaning and changing of the unit simple. All that is needed for immediate operation is a three-eighth inch air connection and a one-half inch water connection.

For further information, contact Alan E. Burman, the Cro-Plate Co., 747 Windsor St., Hartford, Conn.

MOTOR TIMER

General Control Company, Boston 34, Mass. has designed a new synchronous-motor timer for accurate control of a wide variety of timed operations.

This type SY "Promatic" Timer can be used for all time periods between one-half seconds and 24 hours. It actuates five s.p.d.t. load contacts independent of the timer-control circuits. There are two separate solenoids—one operates the clutch and timing mechanism, the other actuates the load contacts. The timer automatically resets for each new cycle.

SCREEN UNITS

The Patterson Foundry & Machine Company of East Liverpool, Ohio, announces manufacture of tandem mounted Gyro-centric Screen Units. This unique design, which features two screens compactly assembled on a common support frame and driven by a single motor, eliminates virtually all vibration, permitting the screens to be installed in towers or in sections of buildings not rigidly supported. A single drive shaft powers the two eccentric drive heads so that the heads rotate in the same direction.

GRINDERS

SPRING SPECIALTY CO., Maywood, Ill., manufacturers of LEIGH HIGH SPEED FLEXIBLE SHAFT GRINDERS and ACCESSORIES, announces a line of universal bench and floor stands for small flexible shaft grinders, (will support machines weighing up to 15 lbs.)

These stands which not only hold the grinders and accessories off the bench, but permit both a proper tool approach to the work with easy accurate hand control of the small cutting tool being used on a delicate mold or die.

This is accomplished by eliminating torque and drag on the spindle. Both overhead spring-suspended balancer type and swivel head pedestal type stands are provided in this new line. The floor models are mounted on ball bearing rubber tired casters. The bench models either clamp or sit on bench. All stands are adjustable for height, revolve (follow) freely and carry trays for keeping expensive tools in order when not being used.

A double electric outlet box with 10' cord and two prong plug can be supplied.

Construction is of castings and tubular steel. They are beautifully finished in black wrinkle enamel.

PHENOLIC RECORDS

Voco, Inc., 33-34th Street, Brooklyn, N. Y. manufacturers of pure vinylite Kiddie Records, use two Stokes Model 294 Dual-Pressure Presses to make preforms for all records made at their plant. Installed a year ago, the presses have "effected a 60 percent saving in the cost of processing raw materials," according to George N. Fishman, president of the company.

"A further development program is being planned at Voco. We are going to compound 'filled' materials for records of any sound fidelity. These filled records are produced from pure resins and other inert elements, which replace the vinyl now used in making our records. The discs will be non-breakable, plastic, and lower in cost. We are sure that Stokes 294 preform presses will play an important role in this development program."

(Continued on page 4)

JOURNAL

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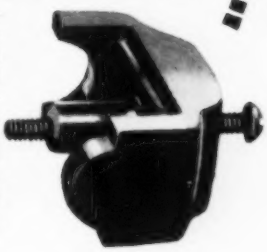
The Society of Plastics Engineers Journal is not responsible for the views expressed by individual contributors. Copy for each issue should be received at 409 Security Bank Bldg., Athens, Ohio, before the fifth of each month.

MODERN PROBLEMS

get modern answers with DUREZ

MOLD COSTS SAVED on "ambidextrous" iron

● In order to embody special sales and user advantages, this iron was planned for molding in 2 component halves. Custom molder used ingenuity, produced body of handle as a single molding of Durez and saved almost 50% on expected mold costs. Reversible cord-retainer insert of same Durez general-purpose phenolic adapts iron quickly for right or left hand operation. An under-cutting profile fixture for flash removal eliminated costly hand cleaning.



IMPROVED DESIGN ENDS NEED FOR JIGS

"Before and after" views show how a leading producer put more sales appeal in this sprayer for farm, shop, and household use. Use of Durez plastics in the new model not only permitted maximum freedom in design, but also eliminated the need for assembly jigs used with former model. The self-insulating property of Durez and its easy cleanability are important in applications of this type.

FOR YOUR JOB, Durez phenolics offer mechanical, electrical, and chemical properties in more than 300 combinations developed to suit widely varying requirements. Your Durez field technician is always available for consultation, and can help you and your molder get the best results for your money. To keep informed on industry's use of phenolics, write (on your letterhead please) for our monthly "Durez Plastics News." Durez Plastics & Chemicals, Inc., 1105 Walck Road, N. Tonawanda, N.Y.

DUREZ

Phenolic Plastics that fit the job

PHENOLIC RESINS — MOLDING COMPOUNDS; INDUSTRIAL RESINS; PROTECTIVE COATING RESINS

CUT SPRAY PAINTING C O $ T $

by rapidly wet painting three-dimensional parts, one color after another, through the use of our accurate, snug-fitting

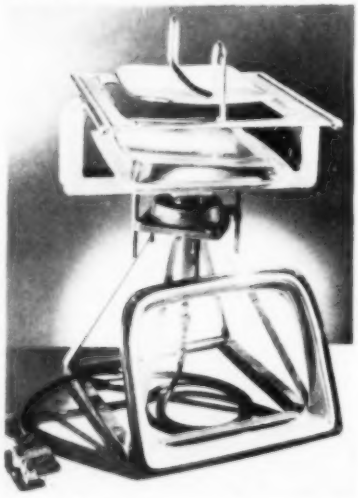
ELECTRO-FORMED METAL MASKS

(Made by Patented Process)

and foot treadle AIR-OPERATED FIXTURES

which position and hold the piece snugly in the mask, maintain the desired pressure, and permit the operator to use both hands.

Illustrated is a 16-inch plastic television window with three-color painted border.



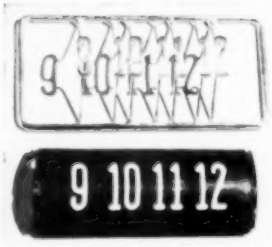
Plug-type masks for keeping depressed areas clear, while spraying background; lip-type masks for protecting the background while painting depressed areas; and block cutout plane surface type masks.

Clean, sharply defined letters and decorative effects are obtained on intricate die castings, stampings and plastic forms by accurate control of painted areas with no fogged edges. Afterwiping or buffing off of overspray is unnecessary. The "loose" inside of letters and numerals, such as "O" and "6", is held in position by arched bridging to eliminate objectionable "ties."

WE ALSO DESIGN, ENGINEER AND BUILD

COMPLETE AUTOMATIC SPRAY EQUIPMENT

(With or Without Masks)



MASK WASHING EQUIPMENT and AIR-OPERATED CLAMPS, FIXTURES AND TOOLS for

positioning parts in masks while painting or holding parts in place for other operations, such as welding.

Automatic, entirely air-operated machines for spray decorating a variety of small plastic and metal parts—one color right after another—at speeds of up to 3600 per hour.

Eliminates the hazards of electric motors, mercury or solenoid switches and the cost of explosion-proof electrical equipment.

Masks are inserted so as to be flush with top of the working table. Spraying is from below. Frequency of mask cleaning greatly reduced.

Dial regulates cycling speed. With a conveyor belt, operator can use both hands to load. Another dial regulates the amount of paint sprayed. At any given setting, the same amount of paint is sprayed on every part, regardless of the speed of the loading cycle. Effects paint savings of up to 50 percent over hand spraying.

Employs 8 latest automatic guns and two 2-gallon air-agitated paint pressure tanks with four insert containers. SEND COUPON NOW!

CONFORMING MATRIX CORPORATION

379 TOLEDO FACTORIES BLDG. TOLEDO 2, OHIO

Please send, without obligation, details on ( ) Hand masks; ( ) Mechanical masking fixtures; ( ) Air-operated masking fixtures; ( ) Stationary automatic spray painting masking machines; ( ) Rotary table automatic spray painting masking machines; ( ) Quotation on masks for parts (or prints) which I am forwarding.

Name

Firm

Street

City & State

What's New?

Companies

DUBOIS PLASTICS

As of January 1st, DU BOIS PLASTICS PRODUCTS, INC., took over the B. F. Oishei Company, owner of Buffalo's largest plant for the production of plastic products, specializing particularly in compression molding. Within the next few weeks, it is expected that all of the operations of the Du Bois plant will be concentrated at the Oishei plant, 165-175 Florida St., Buffalo. For many years, Du Bois has manufactured several plastic items, particularly goggles, at 37 Franklin St.

The molding equipment includes an injection machine from 1 oz. to 10 oz. capacity. The company has successful molding experience on all types of material, particularly the molding of Nylon.

The compression equipment includes presses from 60 tons up to 325 tons.

The tool and die shop has all modern equipment, including 36 x 20 Keller Duplicator and an 800 ton Hobbing Press.

The officers of the Du Bois Company are: Norman J. Taylor, president; Willard F. Sterne, vice-president; Joseph Silbert, treasurer; Charles R. Holsworth, secretary; and Roy A. Bright, general manager.

U. S. FIBER & PLASTICS

The U. S. Fiber and Plastics Corp. of Stirling, New Jersey announces through its president, Hugo B. Meyer, the appointment of W. L. Vega, as Assistant Sales Manager of the Company's MILLION-AIR line of Vinylite plastic inflatables.

In this new capacity Mr. Vega will handle the sales of the Company's plastic inflatable line and assist the president in the development of new plastic items.

BARKSDALE

Barksdale Valves, manufacturers of extreme pressure 'Shear-Seal' Valves, have recently moved to their own plant at 1566 East Slauson Avenue, Los Angeles. Mr. L. S. Barksdale, President, has just announced his resignation as Vice-President of the W. R. Whittiker Co., and General Manager of the Saval Division, and will now devote his full time to Barksdale Valves.

Mr. M. C. Nelson has been promoted from Chief Engineer to General Manager.

In addition to expanded production and more efficient management, customer service should be further improved by a division of Sales territories into four major areas, Western, Southern, Great Lakes, and New England, with a regional sales manager heading each section.

S.A.E. MEETING

The Society of Automotive Engineers, Inc., are meeting June 3 thru 8 at the French Lick Springs Hotel, French Lick, Indiana. A couple of the round table discussions to be held Monday, June 4 from 2:00 to 4:00 P.M. should be of interest to the plastics engineers. They are Plastic Model Techniques led by R. L. Logue, Kaiser-Fraiser Corp. and Automotive Seating led by E. C. Pickard, Ford Motor Company.

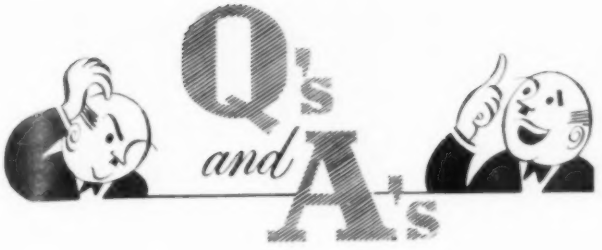
Other meeting dates of the Society are: August 13-15, National West Coast meeting in Seattle, Washington at the Olympic Hotel; September 10-13, National Tractor Meeting and Production Forum at Hotel Schroeder, Milwaukee, Wisc.; October 29-31 National Transportation Meeting at Knickerbocker Hotel, Chicago, Ill.

People in the News

Harold Schor has just resigned from Product Engineering to set up as an independent industrial publicist in New York. He is building an organization for nationwide service, and will specialize in technical products.

Islyn Thomas, National President of the Society of the Plastics Engineers, Inc. has been appointed General Manager of the Newark Die Company.

This Company has been specializing in the manufacturing of molds for the Plastics Industry since 1918.



A:

The answer to the second item of the "Q's & A's" column in the April issue is stated in part as follows:

> "The patents are held in trust by W. B. Hoey and E. D. McCauley. Plastic Processing, Inc., Flint, Mich., is the sole licensing agent. They will give you the information you desire."

I would like to make some corrections to the above statement. The name of the other Trustee is E. D. McCurdy (not McCauley). The sole licensing agent was Plastics Processes, Inc., Cleveland, Ohio, and Plastic Processing Co., Inc. of Flint, Mich. is not connected with the matter in any way.

Any parties interested in the process covered by these patents should communicate with

Mr. E. D. McCurdy
1216 Union Commerce Bldg.
Cleveland, Ohio

(Signed) William B. Hoey

IMS INJECTION MOLD TEMPERATURE REGULATOR

POSITIVE

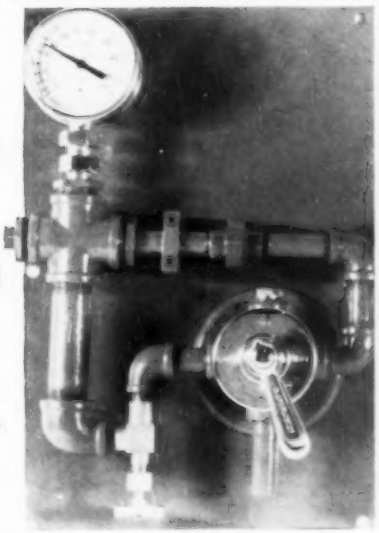
LOW COST

FULLY AUTOMATIC

For Any Mold

For Any Machine

(Where a Circulator Is NOT Required)



Positive to 1°F - Simple to Install
Foolproof - Saves Water - Reduces Scrap
Price Complete, per set of two . . . $255.50
Send for Users List and Special Bulletin

Injection Molders Supply Co.
PENTON BLDG. CLEVELAND 13, OHIO

Letter to the Editor—

Dear Ed:

I have a mighty nice income these days, but it occurs to me that fifty or a hundred dollars would help pay my income tax. So I'm going to enter the SPE Prize Paper Contest this year. As I understand it, **any** topic in the plastics line is okay, so long as the article is original, and there is no restraint on how short or long it should be. Right?

And Ed, old boy, I understand that even if I don't crash through with a prize, the paper may be printed anyway! That is a whole lot in itself—then maybe when somebody wants to know who is W. W. Birdsmith, I can be identified as the author of an article. Good advertising, right?

So—look for my article in the **very** near future.

(Signed) W. W. Birdsmith

Ed's. note: **Right!**

Speakers Listings

All of the sections have asked for assistance in obtaining speakers for the section meetings. Now the National Speakers Committee is asking for the assistance of every member in obtaining the name and address of speakers available throughout the United States and Canada.

Every member has been sent a double post card requesting the name and address of either himself or someone he knows that is available to speak at section meetings. The card also has space for indicating the areas the speaker can cover without difficulty.

Many companies have been contacted for a description of movies that they might have that can be used by the section.

The prompt return of these cards will mean that the new speaker and movie lists can be out early enough for use in planning the Fall section meetings. If you have not completed your card, please do so today.

Anyone having additional information on speakers or movies should contact the National Office.

The roster of membership is in preparation for publication in the June issue of the SPE JOURNAL. If your name and address is not correct as listed on the back of this issue please notify the National Office, 409 Security Bank Building, Athens, Ohio, immediately.

Positions Open

ENGINEER MOLDING

Prominent Philadelphia company performing proprietary molding is in need of Senior Engineer who has experience molding thermosetting materials. Must be familiar with problems inherent in high speed compression molding. Must be well acquainted with techniques of molding inserts. State education and experience, also give salary requirements to

C-51, P. O. Box 3552
Philadelphia 22, Pa.

THE *Injection* MOLDERSCOPE

BY A. R. MORSE

Injection Molder's Supply Co.

Conversion of injection machines to handle thermosetting compounds is feasible, and progress is being made in this field. A review of thermosetting injection.

What has become of the various processes developed for injection molding of thermosetting materials? Recall the flurry the Rockford Hyjector made? It would handle TS in bulk, preform, preheat, transfer mold in one continuous operation. The history of TS injection should be reviewed, however, as TS injection might aid in keeping more injection machines at work.

When Bill Hoey got his idea about TS injection, and had C. D. Shaw help him work it out, he really had something. But legal and patent matters became so involved that molders became afraid to do business. The injection machinery people kicked the process around for a while and dropped it.

Spreaderless Heater

The idea was to take a spreaderless heater and attach a nozzle to it which was intermittently heated. The heat, produced by a short on a copper band around the nozzle, caused the plastic to polymerize partially and to flow through the nozzle into the heated die where polymerization was completed. A water jacket on the nozzle was supposed to keep the material therein from setting up, making the next shot possible. It soon became apparent that the hot nozzle was not needed at all; and dissension in the jet ranks led to C. D. Shaw announcing a process of his own called Flow Molding. Trouble with scoring, plugups or polymerization in the heater, continued to plague the jet people.

Shaw merely discarded the heated nozzle and by brute force pushed the TS material into the hot mold where it set up. He had a modicum of success in preventing premature polymerization by accurate control of his heater with several instruments. Meantime, however, some of the original jet licensees had found that when the nozzle unit became accidentally inoperative, and cold water alone was left running on the nozzle, they got excellent results — better indeed than when using the hot shot nozzle. Of course they also felt that they got out from under the royalty owed on parts produced since the "jet" feature was discarded (Pat. no. 2,296,296) but no trial cases were made.

Jet Heaters

The jet heaters had actually been made by Geo. and Andy Kovacs of the General Machine & Tool Co. These men are probably two of the leading experts in TS injection today, and being shrewd observers it did not take them long to size up the various weaknesses in the jet setup—both the mechanical, technical, and business as well. Chrysler had taken out a jet license along with a dozen or two others, but one by one they dropped out and the jet picture fell apart. Shaw's now separate business also dropped by the wayside, and the increase in high frequency heating and transfer molding about closed the books on jet molding.

But the Kovacs, especially our friend George, had experimented with jet heaters, and they knew how to make them work—by simply providing a cold barrier between the hot mold held at polymerizing temperature and the warm heater held at non-polymerizing temperature. The cold water barrier divided the two zones effectively and overcame the wandering heat that made the jet heater so tough to use, as it picked up heat both from the hot flash and from the hot mold, and the first thing you knew you had a setup.

Water Cooling

The Kovacs applied for and got a patent on their idea. But I sometimes wonder if it will hold water in view of the work done by men like Tony D'Agostino at Insta-Set Div. of Evans-Winter-Hebb, or Blair Gibson at United Plastics, or Eli Adams at Erie Resistor who did make the jet process work using the water cooling feature only.

Now to the practical matter of TS injection. Any machine can be converted. Good density and good part precision are claimed for the process. But the real advantage from an injection molder's viewpoint is that it allows him to quote on TS work without buying compression equipment, or getting permanently out of injection. TS injection is not the clean neat business that TP injection is. It should be segregated and partitioned from the rest of the plant. TS injection is rough on the injection machine—the dust wears the pins and gets in the oil and generally raises hob of a kind the injection molder is not used to coping with.

The cost of a TS conversion will vary, depending on how seriously you take the patents and where you get your TS heater. But basically it will be the cost of a TS conversion heater and plunger, together with transit insulating blocks to keep the hot mold off the platens; and the cost of providing pyrometer controllers for the cartridge heaters used to heat the mold. Actual costs should be around $3500 to $4000.

Hand Feeding

Due to the nature of TS powders they are best fed by hand into the feed chute. A few mineral filled powders can be automatically fed, but tolerance trouble (jamming) is sometimes encountered, and additional material must often be hand-fed on account of shot size, and the smaller higher pressure plungers sometimes used. Bulky material of course MUST be fed by hand, and the double feed stroke or stuffing feature found on modern injection machines will help.

More specific on the matter of TS injection I cannot get at this time. But just remember that TS conversion is definitely possible, and that it might be better to consider it than to shut down for lack of powder or lack or work, or lack of compression and HF equipment to handle thermosetting materials when your present injection machine can and will mold them.

1951 SPE

PRIZE PAPER CONTEST

$200, $100, $50

Rules:

The paper may deal with any phase of the plastics industry from theoretical chemistry to consumer education, from practical shop technique to test procedures, materials, molds or machinery.

The paper must be submitted to the officers of the nearest local SPE section or directly to the National Office, before October 15, 1951.

Local prize winners must submit 5 copies for National judging.

Graphs must be in India ink on white paper or tracing paper.

Credit must be given to any and all sources of information, photos, etc.

National winners are chosen on basis of originality. Previously published material cannot be considered.

All papers become the property of the SPE Journal.

What's New?

Publications

LATEX INSULATION

The electrical wire and cable department, United States Rubber Company, has published a new catalog on specifications and engineering characteristics of latex insulated telephone cables. Statistics on capacity and power factors, transmission characteristics, aging, tensile strength, resistance and constructions, are included. A special section is devoted to a new cable splice housing developed by U. S. Rubber engineers which eliminates hand taping. The booklet is obtainable from the department's headquarters in Rockefeller Center, New York, N. Y.

WOOD PRESSES

R. D. Wood Company, Independence Square, Philadelphia, Pa., manufacturers of hydraulic presses and equipment, have recently issued a photographic booklet covering certain of the Company's production divisions.

The 32-page booklet is designed to give an informative picture of some of the 150-year old firm's facilities, methods, and equipment, particularly as they relate to the manufacture of hydraulic presses, valves, and allied equipment.

HEAT EXCHANGE

The Nukem Products Corporation, 111 Colgate Avenue, Buffalo, N. Y., has recently put out a bulletin describing their Nu-Kast Pumps and heat exchangers designed for the transfer of corrosive liquids, hot or cold.

THREAD INSERTS

The Heli-Coil Corp., 17-23 Thirty-fifth St., Long Island City, N. Y., has put out a 16 page bulletin covering design data on helical-wire thread inserts. It includes the uses of the inserts in the production of and repair of tapped holes in plastics, aluminum, iron, steel and wood.

DESIGN

The Society of Industrial Designers announced the second issue of the authoritative annual summary of design in industry. This book, U. S. INDUSTRIAL DESIGN 1951, is larger and more practical than last issue. It has sections devoted to household equipment, commercial and professional equipment, transportation, and all other important aspects of industry. Each section has a leading article on the market, the problems and interesting trends of the past year.

Company News

FIBERGLAS

Fiberglas Reinforced Plastics sales headquarters have been moved from Toledo, O., to New York, it was announced today by John H. Thomas, vice president of Owens-Corning Fiberglas Corporation and general manager of the company's Textile Products Division.

Company reinforced plastics sales activities will be headquartered in a newly remodeled wing of the Fiberglas Building, 16 E. 56th Street, under direction of Ralph Perkins, Jr., Plastics Sales Manager.

U. S. RUBBER

More than 750 business leaders, civic officials, customers and dealers recently attended the formal opening of United States Rubber Company's new branch office and warehouse at 900 So. Jefferson Davis Parkway, according to E. J. Espenan, operating manager. The event was marked by an "open house" reception and a guided tour of the new building.

Designed to provide better service for customers, it will be headquarters for the distribution of products for all of Louisiana, as well as parts of Alabama, Florida and Mississippi.

POLYMER CORP.

Effective May 1, 1951, The Polymer Corporation, Reading, Pa., is turning over the sales of all its products to a separate company, The Polymer Corporation of Pennsylvania. This change is necessitated because of confusion as to the distinction between the company and a concern of exactly similar name, manufacturing different types of products, located in Sarnia, Ontario, Canada.

The Polymer Corporation will now restrict its activities to production, research, and development. The Polymer Corporation of Pennsylvania will sell the manufacturing company's Nylon, Teflon, and Kel-F rod, strip, and tubing, as well as all fabricated products, under the brand name of "Polypenco." No change of management or control is involved in this reorganization.

In times like these...

IT'S THE EXTRAS THAT COUNT!

WATSON-STILLMAN

300 oz.

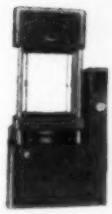
Injection Molding Machine

DIE SPACE 48" x 72"
CLAMP 1500 TONS

With materials and labor cost spiraling . . . delivery dates increasingly stepped-up . . . an imminent shortage of skilled operating labor—it is more than ever important for PLASTIC MOLDERS to know all their suppliers . . . and everything each has to offer.

As THE pioneer and fifty-two-year consistent leader in the design and construction of Plastics Molding Machinery, W-S is in an especially good position to offer molders of every size and type a complete service. Not only the finest and most extensive line of molding machinery anywhere available . . . but extra dividends in the form of engineering counsel on materials, die-design, and plant layout.

In times like these, such extra service, extra attention to every vital phase of your operation is increasingly valuable. Because of its machine capacity range of 1-300 ounces, and the broadest range of injection, compression and transfer molding machines, W-S is your logical consultant on any projected expansion. And once you have enjoyed the advantages of COMPLETELINE service—extending far beyond equipment needs alone—you will always consult W-S first on new molding equipment and how to use it.



Compression Molding Presses — 50 to 1200 Tons.

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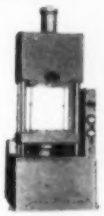
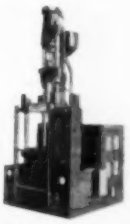


Transfer Molding Machines—30 to 1200 Tons.



Vertical Injection Molding Machines—1, 2, 4, and 6 ounces.

Preform Tableting Machines—10 and 100 Tons.

9-L-38

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TRADE JOURNALS AND EDITOR PEEVES PROVE LIVELY FARE AT CENTRAL OHIO

By Richard J. Francis

On April 20th the Central Ohio Section met in the Berwick Hotel in Cambridge, Ohio. President Henry Kuhlman received nominations for the election of officers to be held at the next meeting, and president-elect Robert King of Battelle Memorial Institute introduced the speaker.

In his interesting and well illustrated talk Harold Schor, Associate Editor of Product Engineering, pointed out that industrial publicity is one of four methods used to transmit information from a manufacturer to his potential customer. In modern practice, it ranks as an equal partner with (1) direct selling, (2) sales promotion (exhibits, dealer contacts, etc.) and (3) paid advertising.

In placing publicity as part of the sales picture, Mr. Schor outlined five steps in a typical industrial sale: (1) making the contact; (2) arousing interest in a type of product; (3) creating preference for a particular company's product; (4) making a specific proposal to the prospective customer; and (5) closing the order. He quoted figures to show that much of the salesman's valuable time is consumed in non-productive activities, such as traveling and paper work. For instance, the average salesman spends only 4 hours per day face-to-face with customers and prospects; and he makes an average of only 7 calls per year on a potential prospect.

Mr. Schor pointed out that the salesman might best concentrate his valuable time on steps 4 and 5, leaving the three "approach" steps to be accomplished by publicity and advertising, at low cost per contact. He was careful to emphasize the fact that publicity and advertising each has its own place in the manufacturer's overall promotion plans. In his capacity as an industrial editor, however, he limited his talk to the role of industrial publicity.

Industrial publicity when properly practiced can have both an educational value for the reader, and a sales value, direct or indirect, for the manufacturer. Mr. Schor listed the following as some of the reader benefits which can result from use of proper techniques in publicity:

1. Teaching better production and maintenance techniques.

2. Familiarizing readers with both advantages and limitations of new products.

3. Suggesting new uses for standard materials and components.

Harold Schor

4. Familiarizing designers with properties of engineering materials.

5. Announcing new products, materials, processes, and services.

6. Promoting distribution of literature, attendance at trade shows, and similar activities.

7. Developing the prestige of a company by means of full-length feature articles carrying the byline of an executive, engineer, research man, or sales engineer.

Since the primary "target" for industrial publicity is the industrial press, Mr. Schor outlined the various types of publications by means of a chart. This chart broke down industrial publications in two classifications: "Vertical" publications — those serving a particular industry, such as aviation, petroleum, etc.; and "horizontal" — those serving a specific function, such as design engineering, plant management, etc., and cutting across all of the vertical fields. He pointed out that not all publications are exclusively vertical or horizontal and indicated on his chart those publications which fall into both categories.

Mr. Schor then outlined the principle techniques used in transmitting publicity material to the industrial press. These include:

New product release — usually accompanied by a glossy photograph showing the component or an application of the material described. Such a release goes to all of the industrial magazines which might in any way be interested in the product, and which have new product departments.

Syndicated news release—such a release may describe company news, or items of more general interest than a specific product, and may go to a carefully selected group of newspapers as well as industrial magazines. Here, pictures of dramatic news interest usually count.

Full-length articles — these are usually byline articles that may run anywhere from 3 to 8 or more pages in a magazine, and fully describe a new development, summarize the present state of an existing field, or in some way bring information to awareness that was not previously available, or existed only in fragmentary form. Such articles are usually handled in one of two ways: either completely exclusive, which means that no other publication gets it; or "exclusive-in-your-field," which means that the article goes to only one publication in a particular group. For instance, an article on how to design gears can be offered to only **one** of the design publications; however, it could be "reslanted" and offered to a gear (vertical) publication.

In addition to these common techniques, Mr. Schor said that a very valuable source of publicity is the company house organ. The trend, today, is toward "externalizing" such publications, and including a good deal of product and technical information in them. All industrial magazines of interest should be put on the mailing list for the company house organ.

Mr. Schor concluded his talk with a list of "editor's pet publicity peeves" some of which proved to be highly amusing to the SPE audience. These are the things which make an industrial editor gnash his teeth:

1. Release not in field of publication.

2. Superficially in the field, but nothing of practical importance to the reader.

3. Old stuff disguised as new.

4. Too many generalities — not enough facts.

5. Too much rhetoric.

6. Sales talk—too much boasting about company and product.

7. Trivial facts presented as a world revolution.

8. Ten words to do the work of one.

9. Too frequent mention of company and product name.

10. Releases written to please vanity of company executives.

11. Hints in conveying letters that editor should consider present or future advertising.

12. Failure to understand the basic difference in editorial objectives between industrial and other publications.

13. Failure to understand the editorial aims of specific leading industrial publications.

(Continued on page 24)

Mold Shrinkage of Thermoplastic Materials

Professional Activities—Report of Subcommittee on Molding Techniques

Chairman

Sanford E. Glick

Monsanto Chemical Co.

Variables which affect shrinkage of thermoplastic molded parts include gate size, material temperature, mold temperature, plunger dwell, fill time, and die block changes under stress. The magnitude of these effects are discussed for the common thermoplastics.

INTRODUCTION

For the year 1950, the Subcommittee for Molding Techniques—Thermoplastics, selected the topic "Mold Shrinkage of Thermoplastic Materials." During 1949 a special committee developed a report on "Pin Point Gating." Previously, there has never been a program activity set up for the study of thermoplastic molding techniques. Accordingly, it was felt that a topic such as the proposed one should prove of real interest to the industry.

The printed literature on the subject of mold shrinkage is only general in nature. Most of the material manufacturers publish data sheets which list range of mold shrinkage for the various thermoplastics. Frequently, a range of .002- .008 inches per inch is presented. Naturally, such a wide range often does not permit the mold designer accurately to plan a mold which will yield precision parts. The S.P.I. Handbook, issued in 1947 contains a section on mold shrinkage which is only general in nature. Furthermore, most of the information contained in this chapter (pages 109-121) concerns itself with mold shrinkage of thermosetting materials. So too, there is a comprehensive section on standards for tolerances in the S.P.I. Handbook for a number of different thermoplastic and thermosetting materials (pages 178-212). However, neither of these suffice in presenting clearcut information to the field on the mold shrinkage to be encountered with various thermoplastic materials.

The ASTM has a test method for measuring mold shrinkage (D551-41). This method is quite accurate in offering a standard procedure for measuring mold shrinkage. However, again, it does not offer specific information to the molders on what shrinkage is to be encountered with the different materials. Tentative specifications for molds for test specimens of molding materials has an ASTM designation

Sanford E. Glick

D647-45T. Subcommittee 9, Committee D-20 of the ASTM is also working on test methods for measuring bulk factor as well as designing a die to measure weld strength. But, there is no comprehensive listing to date of data which would clarify the numerous variables associated with mold shrinkage.

Accordingly, it seemed that a comprehensive work on specific mold shrinkages for the various thermoplastics would greatly contribute toward increasing the knowledge of what plastics can do. In order to best develop this information, representatives of the material suppliers and injection molders were contacted and requested to submit whatever information was available. The following report is a compilation of the information received to date on this subject.

GENERAL CONSIDERATIONS

With the advent of larger injection molded pieces requiring more and more close dimensional tolerances, the problem of mold shrinkage is becoming increasingly pertinent. Many factors contribute toward the actual value which results. Dimensional tolerances are influenced by (1) Mold Shrinkage, (2) Thermal Expansion, and (3) Dimensional Stability. Such items as size of gate, plastic temperature, mold temperature, and length of plunger dwell are involved in the mold shrinkage of a part. The number of gates is also of importance. Mold shrinkage is normally the difference between the size of a piece after it has reached equilibrium at some specified temperature and the size of the cavity in which it was molded. One molder of refrigerator breaker strips found that with one gate larger shrinkages resulted, whereas with three gates on the same piece the shrinkage was reduced to less than 0.001 inch inch. Also, the temperature at which the part is measured is extremely important because of the high coefficient of thermal expansion which is characteristic of most of the thermoplastics. Furthermore, there is a certain amount of after shrinkage on several of the thermoplastic materials. This after shrinkage shows up on some of the more critical molding jobs which have been encountered in recent months. Although the latter is a factor which possibly is not the responsibility of the mold designer who specifies the size of the mold which is to produce a molded article within the allowed dimensional tolerances, nevertheless it does exist and may cause eventual failure of a given part.

Turning now to an examination of what occurs during the molding cycle, the plastic is forced into a die cavity during the injection molding process. If it is assumed that the plastic material is sealed into the die cavity under some conditions of temperature and pressure, then certain phenomena result. As the plastic cools in the die cavity, theoretically, it should densify and shrink. However, as long as the plastic mass is fluid, instead of shrinking it remains in contact with the cavity wall and relieves that pressure under which it was sealed. Shrinkage of the plastic in the die

cavity occurs only when (1) the plastic has lowered to such a temperature that it is no longer mobile, or (2) the pressure sealed in the plastic has lowered to zero.

A theoretical treatment of shrinkage discloses that the temperature, pressure, volume relationship of styrene plastic is represented by the equation of state as follows:

$(P+27{,}000)\ (V-1.422)=11.18\ T+5134$

where P is the external pressure on the plastic in psi, V is the specific volume in cubic inches per ounce and T is the temperature in degrees F.

Actually, when plastic is forced into a die cavity, the hotter the plastic the less dense it is and shrinkage is large. On the other hand, the higher the pressure, the more dense is the plastic and the degree of shrinkage is reduced.

To illustrate this point, let us determine the specific volume of styrene plastic in the two sets of conditions, first that of the solidified plastic at 75° F, and secondly that of the molten plastic at 500° F. and under an external injection pressure of 20,000 psi. From the equation of state we find that:

At zero pressure and 75° F., the specific volume is 1.643 cubic inches per ounce, while at a pressure of 20,000 psi and a temperature of 500° F., the specific volume is 1.650 cubic inches per ounce.

Now, if we assume various size cubic moldings, molded under conditions of 500° F. and 20,000 psi and then cooled to 75° F., we find that the theoretical shrinkage can be calculated as per the following table:

Size of Molding	Size of Die Cavity Required if Molding is Preformed at 20,000 psi, and 500° F.	Linear Dimension of Cubic Die	Size of Molding Cooled to 70° F.	Linear Dimension of Cubic Molding	Linear Shrinkage of Molding Compared to Die
oz.	cu. in.	in.	cu. in.	in.	in.
5	8.250	2.021	8.215	2.018	0.003
10	16.500	2.546	16.430	2.542	0.004
100	165.000	5.485	164.300	5.477	0.008

However, in today's conventional molding the case represented above never occurs. Numerous complicating factors are present. To begin, the moment plastic is forced into the die cavity it contacts the wall surfaces thereby cooling and densifying. During the packing period of the molding cycle, assuming a flow passage is open, additional molten plastic is forced in to fill the void resulting from shrinkage. This phenomenon causes the finished molding to assume more nearly the dimension of the die cavity. In other words, it reduces the shrinkage.

Die Spreading

Also, with conventional molding practices, after the injection time ceases and the plunger returns, discharge occurs throughout the die cavity. Discharge from the die cavity occurs only when gates, runners, and sprues are still molten and have not sealed. Discharge relieves a portion of the pressure within the die and since material is lost from the die cavity this leads to the production of moldings which do not conform to the shape of the die cavity. Common deficiencies of this type are exemplified by sink marks and internal bubbles in the moldings.

Other factors which can very easily affect the dimensions of the finished molding are (1) the changes which result in the die block itself as the result of the tensile strain imposed upon it during the clamping operation and by the hydraulic forces transmitted through the molten plastic itself, and (2) die spreading, the result of exceeding the clamping pressure. Another factor (3) which easily affects the dimensions of the finished piece is the increasing temperature of the die which also tends to enlarge the size of the die cavity. To illustrate point No. 2, namely die spreading, the following may show how relatively easy it is theoretically to exceed the clamping pressure. As an assumption, the job in question has an area of 200 square inches and is being molded in a machine with a clamp of 650 tons. From these figures it is readily seen that a hydraulic pressure, as exerted by the molten plastic in the die cavity of merely 6,500 psi, will spread the die. Even assuming a liberal safety factor in the stated clamping pressure, or a loss in injection pressure due to friction, it must be realized that 20,000 to 30,000 psi are the usual rated pressures of injection molding machines of the conventional designs.

Of course, the above listed factors are all acting simultaneously during the injection molding process. In addition, due to the nature of the molding process which is inductive to the formation of strains in the molded piece, the plastic does not always follow the equation of state, at least not instantaneously. Of the three types of residual strain in injection molded pieces, namely (1) quenching stresses, (2) configurational volume strains, and (3) frozen orientation, perhaps the second, configurational volume strains, is most important insofar as shrinkage is concerned. Configurational volume strain may best be considered as delayed shrinkage. This type of strain occurs at and below the softening temperature. As a plastic is cooled to the softening point, the molecular chains become less and less mobile, and although on further cooling the plastic tends to follow the equation of state, this is accomplished at a slower and slower rate. Therefore, it is not surprising to find that a molded sample will slowly shrink over a long period of time before it ultimately reaches a stable volume.

Fill Time

Research work has indicated that perhaps the most important factors in the injection molding cycle are the fill time and packing time. Of course, it should be realized immediately that every molding variable affects the fill time, therefore this conclusion is apparent. Undoubtedly, fill and packing times figure heavily in the study of shrinkage.

For a complete answer to the question of plastic mold shrinkage, each effective variable of the injection molding cycle should be considered as independently as possible. Such variables are die temperature, gate sizes, die design, stock temperature, effective pressure, size of feed cushion, ram forward time, die closed time, booster, ram speed, plastic formulation, and others must be considered. Also, at least two types of shrinkage must be considered — shrinkage of a solid piece, and secondly the shrinkage of pieces which shrink around some sort of a core.

Also of general interest are the following considerations:

1. The use of insufficiently large gates or runners will increase the shrinkage.

2. The effects of changes in the several factors influencing shrinkage are additive, and

3. Some shrinkage may continue with age.

The statements of quantitative effects of the several variables which will be discussed subsequently ought to be accepted as approximations only, applicable chiefly to major dimensions of the molded article. In many cases a molded bar will show shrinkage in length but expansion in width or thickness in accordance with Poisson's ratio. A disc may show shrinkage in diameter, but expansion in thickness, and there is some indication that shrinkage in diameter increases with the thickness of the disc.

Large Area

Moldings of large area having thin sections parallel to the parting line generally show expansion in thickness of this section because of lack of sufficient clamping pressure or lack of

rigidity of the mold. Also, simple moldings such as discs will tend to show greater shrinkage than moldings of complicated design where the core pins and plugs serve as shrink fixtures within the cavity.

It should be realized, however, that on many commercial molding jobs, shrinkage is only one factor to be considered. Frequently conditions producing minimum shrinkage introduce other molding problems such as increased weight of molded items, flash, cracking, sticking, etc. Consequently, a compromise and balance of molding conditions is required.

CASE HISTORIES

The following examples illustrate certain problems which molders encountered where mold shrinkage was an important consideration:

Case No. 1

One wall tile molder was in the process of producing large tile. Initially, a mold shrinkage figure of 0.0025 inch per inch was used. At the start, a gate with the dimensions 0.030 x 1.25 inch was employed. However, the resulting tile had a keystone shape in which the width near the gate was 0.020 inches greater than the width opposite the gate. This condition was eventually corrected by one of two means. In one specific case, new molds were built in which the cavities were actually tapered with a 0.010 inch taper on each side. Another approach to the problem was to reduce the size of the gate to the dimensions of 0.030 x .150 inch. Both of these devices were effective in producing tile within tolerances. The latter means permitted sealing off at the gate and prevented subsequent packing and expansion of the dimension near the gate. Another means of eliminating such differential shrinkage is to control the mold temperature so that the region near the gate is colder than that farthest away.

Case No. 2

Another tile molder found as much as a fivefold difference in shrinkage depending on the length of time during which the injection plunger was kept forward. With short plunger forward time (10 seconds) a shrinkage of 0.001-0.003 inches over a 4¼ inch span resulted. Such a figure was tolerable but warpage of the tile resulted. By increasing the plunger forward time to 17 seconds, the warpage was eliminated, but the shrinkage increased to 0.009-0.010 inch on the side away from the gate. The dimension of the gate side was the exact size of the cavity.

Case No. 3

In molding a spool 3.709 inches long, one molder had to submit samples which had a tolerance of plus or minus .005 inches. After varying the molding conditions, this molder found that as little as a 100 pound difference in gauge pressure produced spools with a length of 3.719 which were outside the tolerance limits. Accordingly, it was found necessary to maintain absolute control of the molding conditions to produce molded items that were passable. This die has 24 cavities and it was found necessary to vary the gate sizes depending on the distance from the sprue. One cavity has two gates and this particular cavity produces items within a tolerance of plus or minus 0.001 inches.

Case No. 4

One of the most dimensionally accurate jobs produced by injection molding is the reed employed in the harmonica. Unbelievable tolerances of as close as plus or minus 0.0001 inches are achieved. To maintain such tolerances, precise control of temperature must be maintained. Mold temperature is consistently kept between 120 and 121° F. and the injection cylinder temperature is also kept within a narrow range.

MOLD SHRINKAGE VALUES

The following is a list of mold shrinkage figures actually employed by some of the largest injection molders in the country:

Cellulose Acetate	0.005 in. per in.
Methyl Methacrylate	0.005 in. per in.
Nylon	0.015 in. per in.
Polyethylene	0.035 in. per in.

For styrene plastics, some disagreement seems to exist. One large molder uses a figure of .004 inch per inch whereas another one who molds large refrigerator parts uses a figure of .003 inch per inch. A large wall tile injection molder uses a figure of 0.0025 inch per inch styrene plastic mold shrinkage. Another styrene molder qualifies his figures by saying that a value of 0.002 inch per inch should be used when the styrene is molded around a core, whereas a figure of 0.007 inch per inch should be used when the core is pulled. One styrene material supplier suggests the following rule:

> For dimensions up to ¼", a value of plus or minus .003" should be used; for ¼ to 6", a value of plus or minus 0.005"; for sizes above 6", a value of 0.001" per each inch of length.

One of the country's largest mold makers uses the following rule for shrinkage of styrene cap closures. A figure of 0.006 inch per inch is used on the molded parts. On cap closures, nothing more than Class 2 fit is guaranteed. For estimation purposes, a figure of ½ of the thread depth is used for shrinkage on a cap. For example, a bottle cap for a one inch thread with a depth of thread of 0.060 D would be constructed with all thread dimensions 0.030 inches greater. This is arrived at by taking ½ times 0.060. In order to obtain the best possible fit, heat treated steels have been used for forces so that these forces may be later ground to size if fit is not close enough.

MATERIALS

In the following section, the individual plastic materials will be discussed in relationship to mold shrinkage.

CELLULOSICS

The cellulosics undergo a shrinkage which is twofold in nature. Primarily there is the mold shrinkage and superimposed on this is the shrinkage subsequent to molding.

Shrinkage of cellulosics subsequent to molding is about 0.003 inch per inch at normal temperature, depending somewhat on the formula and flow of the material and the shape and thickness of the molded part. About ⅔ of this shrinkage takes place in the first 48 hours after the pieces have been removed from the mold.

Shrinkage at any time subsequent to molding is created by subjection to higher than normal atmospheric temperatures. For instance, at 110° F. for 50 days, a typical formula and flow of the cellulosics showed shrinkage depending on the thickness as indicated below. Loss of weight in shrinkage approached equilibrium at the end of 50 days.

Thickness in inches	Loss of Wt. in %	Shrinkage in in. in.
0.1	1.8	0.008
0.2	1.2	0.005
0.3	0.9	0.004
0.4	0.7	0.003
0.5	0.5	0.002

The shrinkage is obviously due to weight loss; and the weight loss increases with thinner pieces due to greater surface weight ratio.

Mold Shrinkage

Turning now to a discussion of mold shrinkage, it has been found that in order to avoid shrink marks which are caused by cooling under insufficient pressure, the gate and runners should be somewhat proportionate to the thickness of the section in the molded article. Due to the fact that the cavity is constantly cooled, an injection molded piece chills very fast. If the gate and runners are small and the section of the molded piece relatively large, the gates and runners "freeze" first and thus cease to give continued pressure on the casting during the two or three seconds in which it is setting; this causes shrinkage. Increasing the size of the runners and gate or raising the mold temperature and holding the high pressure on for a longer time, are the usual means of overcoming this difficulty. This is a consequence of additional material being forced into the capacity by virtue of the gate and runner remaining fluid. Dropping the pieces in water immediately after ejection

from the machine will sometimes minimize the shrink marks.

Injection mold shrinkage is influenced by the thickness of the piece, size of gate, pressure employed, temperature of material in the injection cylinder, and temperature at which the piece is ejected. Shrinkage may also result from too short a dwell of the injection plunger at the end of its forward stroke. When the cross-sectional area of the molded piece approximates the area of the runner, normal mold shrinkage is about 0.002 to 0.003 inch per linear inch. As the thickness of the molded piece is increased with respect to the cross section of the gate and runners, mold shrinkage increases.

Core Molding

To eliminate the necessity of very wide sprues, runners, and gates for preventing shrinkage in the piece which must of necessity be molded solid, it has sometimes been found expedient first to injection mold a core in a separate mold; this core is used in turn as an insert over which coating is injected as a second operation in a second mold. Shrink marks in such a molded insert are of no great importance because they are subsequently covered. The coating, being a relatively thin section, requires only a small gate which is easily trimmed. Another advantage of this method is that scrap can be used in the core, unless it is so dark that it would show through the coating.

Along the same line of thought, sections of approximately equal thickness are desirable in any injection molded piece, as far as possible. Where the article to be molded requires both thick and thin sections, the possibility of coring the thick sections should be considered seriously. A thin section leading to a thick section in an injection mold has the same effect as too restricted runners or gates. To prevent shrink marks, a piece which has both a thick and thin section should be gated at the thick section, using large gates.

A long, thin article with a gate at one end has greater bending strength than one with an entrance at the center, with the material flowing in both directions from that point. On the other hand, a cup-shaped article not subjected to any particular bending stresses is logically gated at the center of the bottom.

Another company manufacturing cellulosics reports the following:

In the pieces molded ($^1/_2$x$^1/_2$x5 inch impact bar, 1/16x$^1/_2$x5 inch flex strip, 1/8x2 inch disc) the shrinkage is found to be somewhat greater in direction perpendicular to the flow of the plastic. It was found that with moldings of thick cross-sections (impact bars) the shrinkage increased with increase in injection temperature, while with thin pieces (discs and flex strips) the shrinkage decreased with higher temperatures. This variation of shrinkage is probably caused by differences in the effect of two compensating shrinkage factors. Higher plastic temperatures with the concommitant lower viscosity and consequently higher mold pressure cause a greater plastic compression, thereby reducing any mold shrinkage. However, higher temperatures will allow a greater thermal contraction with shrinkage on cooling. With restricted flow passages, as in thin moldings, pressure variation caused by temperature changes will be accentuated, while in the thick pieces the thermal contraction is the controlling factor.

It was found that different plasticizer formulations cause different shrinkages. In regard to shrinkage, some formulations were quite sensitive to changes in molding conditions, while in other formulations the shrinkage was relatively unaffected by varying the conditions. When different plasticizer formulations were compared, it was sometimes found that the one which gave the greatest shrinkage at very low injection temperatures would give the least shrinkage at much higher temperatures. Such seemingly inconsistant phenomena may be significant or may be merely a result of the uncontrolled variables.

In general, all statements made in the preceding paragraph concerning different plasticizer formulations will also apply to different flow grades in the same formulation.

Thin Pieces

The thin pieces generally shrank much less than the thick pieces. The flex strip length shrinkage varied from about 0 to 0.0036 inch per inch, the disc diameter from 0.0045 to 0.008 inch per inch and the impact bar length from 0.005 to 0.012 inch per inch. The extreme values of mold shrinkage listed generally occurred

TABLE 1

Styron 666 — **SHRINKAGE OF ANNEALED TENSILE BARS, INCH INCH**

Group No.	Molding Conditions	Annealed 1 Hr. at 165° F.	Annealed 8 Hrs. at 165° F.	120 Hrs.	144 Hrs.	22 Days 528 Hrs.	100 Days	Inch Inch Expansion After Annealing
1	Average	.0010	.0015			.0015	.00163	.0001
2	Hi Temp.	.0014	.0014		.0013	.0013	.00132	.0001
3	Lo Temp.	.0015	.0018		.0017	.0018	.00176	0.0
4	Hi Press.		.0014			.0014	.00143	0.0
5	Lo Press.		.0016			.0017	.00161	.0001
6	Short M. Closed	.0010	.0015			.00148	.0015	0.0
7	Long M. Closed	.0011	.0017			.00168	.0017	0.0
8	Short P.F. Long M.C.	.0010	.0015			.00147	.0014	0.0
9	Long P.F.	.0011	.0015			.00154	.0015	0.0
	Average	.0012	.0015		.0015	.0015	.0015	0.0000
Styron 475								
1	Average	.0027	.0041		.0041	.0042	.0041	0.0
2	Hi Temp.	.0022	.0032	.0034		.0033	.0035	.0003
3	Lo Temp.	.0033	.0052			.0052	.0052	0.0
4	Hi Press.	.0025	.0039		.0040	.0040	.0039	0.0
5	Lo Press.	.0029	.0045		.0046	.0045	.0048	.0003
6	Short M. Closed	.0025	.0037	.0038		.0037	.0038	.0001
7	Long M. Closed	.0033	.0049	.0049		.0049	.0052	.0003
8	Short P.F. Long M.C.	.0022	.0034	.0035		.0034	.0035	0.0
9	Long P.F.	.0028	.0042	.0043		.0042	.0043	.0001
10	Cold Mold	.0040	.0058	.0057		.0057	.0058	0.0
	Average	.0028	.0043	.0043	.0042	.0043	.0044	.0001

FIG. 1. EFFECT OF MOLDING VARIABLES ON MOLD SHRINKAGE OF NYLON

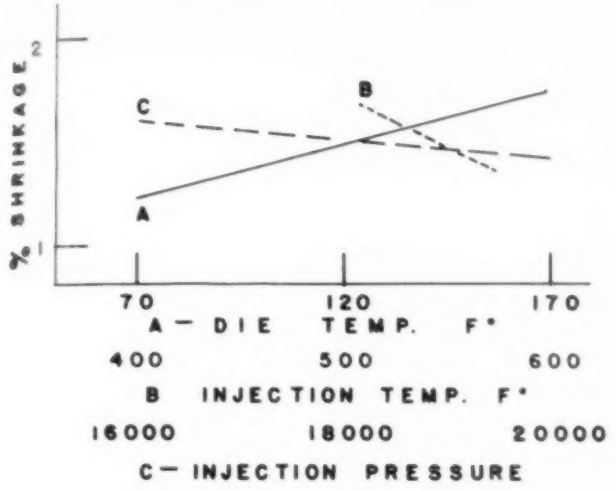
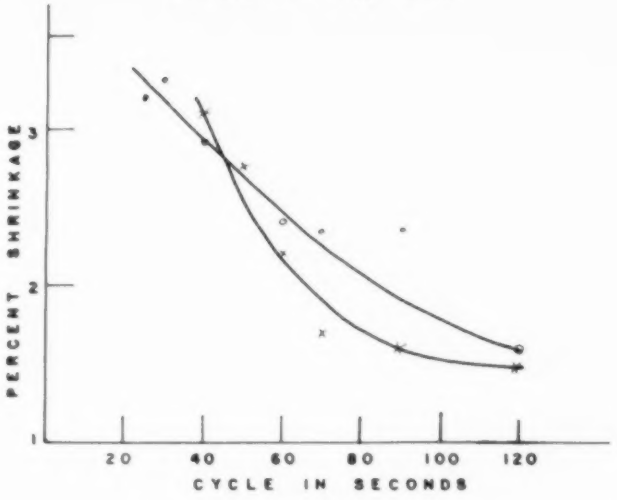


FIG. 2. EFFECT OF CYCLE ON SHRINKAGE OF FM-10001: 4" x 1/4" DISC.



with the unusual molding conditions and would not be expected in a commercial molding. The normally expected shrinkage ranges from about 0.002 to 0.007 inch per inch.

The above information which was developed by one company should not be taken as absolutely conclusive, however it does represent what actually occurred with some specific moldings of ethyl cellulose, as determined by plotting and analyzing the results of some 1500 individual measurements.

NYLON

The conditions of molding which give minimum shrinkage are a cold mold, a long cycle, high injection temperature, high pressure and high speed. Under these conditions, the shrinkage of nylon is about 0.007" per inch.

But under normal molding conditions, involving a hot mold and moderate injection temperatures, this shrinkage will usually be about 0.015" per inch and shrinkages as high as 0.035" per inch have been observed. Increase in the temperature of mold increases in shrinkage at a rate of about 0.001" per inch for each 20° F. Figure (1) illustrates this relationship, and also the effect of injection pressure and temperature.

Injection temperature, pressure, and speed are relatively unimportant. An increase of injection temperature by 20° F., decreases shrinkage by 0.001" per inch, but the molding range is so narrow that little change in shrinkage can be effected by altering injection temperature. An increase of 2000 psi in injection pressure reduces shrinkage by 0.001" per inch. Increasing the speed of injection from the slowest to fastest decreases shrinkage by only 0.001" per inch.

Use of a very short cycle may double the amount of the shrinkage, as indicated by Figure (2). The two curves represent data from two different tests.

POLYETHYLENE

Work both in the field and laboratory on a prediction of shrinkage indicates that a sample mold should be made prior to actual production work, if at all possible. One company conducted a laboratory investigation to determine the effect of molding conditions upon the shrinkage of polyethylene. As a result of this study, which included a variety of shapes, the following observations were made:

(1) The minimum shrinkage of PM-1 polyethylene is about 0.010" per inch (see Figure 3). The molding conditions for minimum shrinkage are—low die temperature, high injection temperature, and high injection pressure. A hot die, low injection temperature and low injection pressure caused an increase in shrinkage to 0.030" per inch.

(2) Mold temperature is an important factor in shrinkage. An increase of 20° F. in die temperature increases shrinkage by 0.001" per inch.

(3) The effect of varying the injection pressure is small. A decrease of 3000 pounds per square inch increased shrinkage by 0.001" per inch. It should be noted also that these effects are additive (see Figure 4). If existing conditions permit a decrease in mold temperature, and an increase in injection temperature, and also injection pressure, the advantages gained will be additive. For example, in Figure 4, starting at the right hand extremity of line C, shrinkage is reduced by lowering the die temperature, as represented by transposed line A. Shrinkage is further reduced by increasing the injection—temperature as shown as transposed line B.

(4) No significant change in shrinkage is obtained by varying the rate of injection.

(5) Shrinkage appeared to be complete within 24 hours.

(6) Diametral shrinkage of an edge-gated disc is the same in the direction of flow as in the direction perpendicular to flow.

(7) Successive shots molded under similar conditions will conform well with one another. If conditions are constant, a tolerance of 0.002" per inch should be maintained easily.

This information indicates trends rather than specific effect, and illustrates the importance of good control of mold temperature and injection temperature to minimize the variation and shrinkage.

In Figure (5) there is presented a graph showing the combination of factors effecting molding of polyethylene. It can be seen that minimum shrinkage is found in the lower right corner of Figure (5), but the resulting increase in cycle makes this area undesirable. Consequently, some balance of molding conditions must be accepted. The mold shrinkage of polyethylene can be decreased by incorporating inert fillers, such as fine particle calcium carbonates and clay. Mold shrinkage for the filled material is approximately 1½ to 2½% as compared with 2½ to 3½% for the unfilled material at 450° F. At higher temperatures, the shrinkage may be considerably higher.

METHYL METHACRYLATE

The conditions of molding which give minimum shrinkage are low mold temperature, high injection pressure, high injection temperature, and rapid rate of injection. Under these conditions, the shrinkage will be about 0.001" per inch.

But under normal molding conditions, i.e., hot die, medium injection temperatures and slow rate of injection, the shrinkage will be about 0.004" per inch.

Injection pressure has a marked

FIG. 3. EFFECT OF MOLDING VARIABLES ON MOLD SHRINKAGE OF POLYTHENE

(Du Pont)

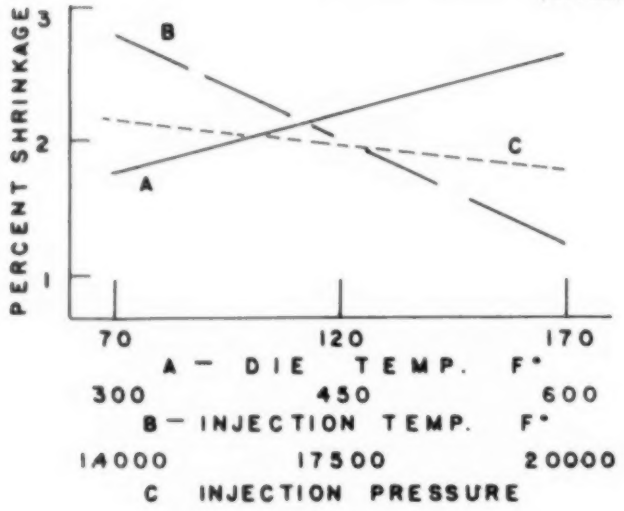


FIG. 4. ADDITIVE EFFECTS OF MOLDING VARIABLES ON MOLD SHRINKAGE OF POLYTHENE

(Du Pont)

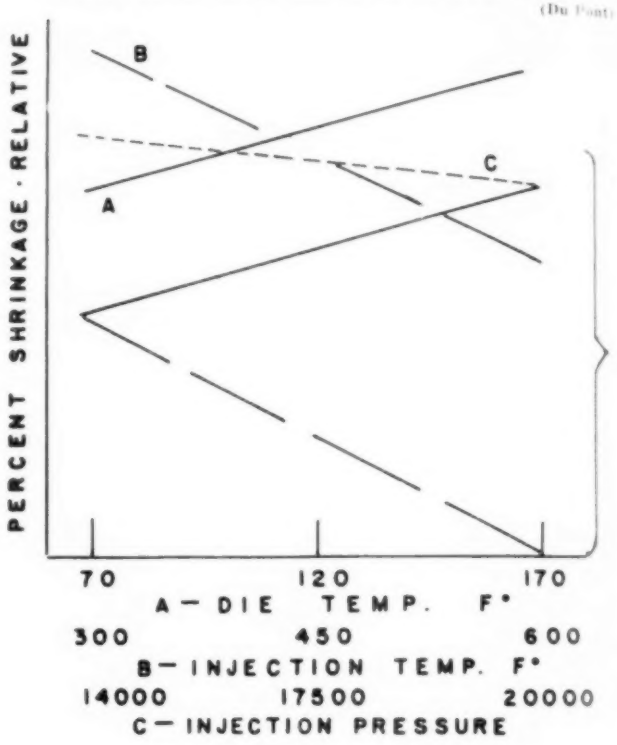


FIG. 5. COMBINATION OF FACTORS AFFECTING MOLDING OF POLYTHENE

(Du Pont)

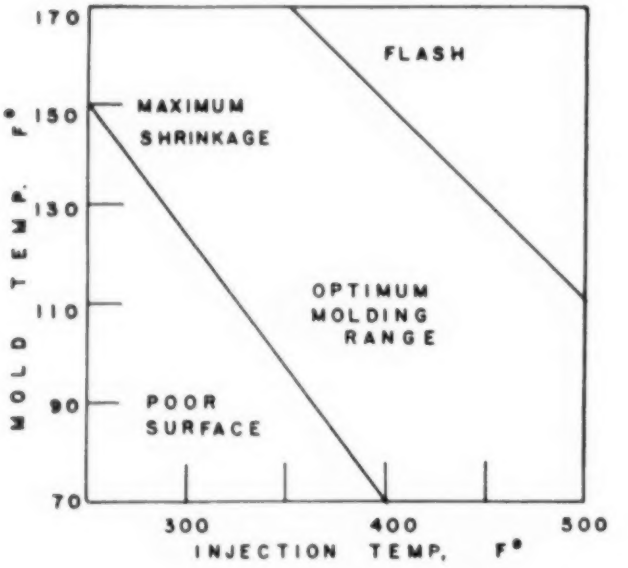


FIG. 6. EFFECTS OF MOLDING VARIABLES ON MOLD SHRINKAGE OF METHYL METHACRYLATE

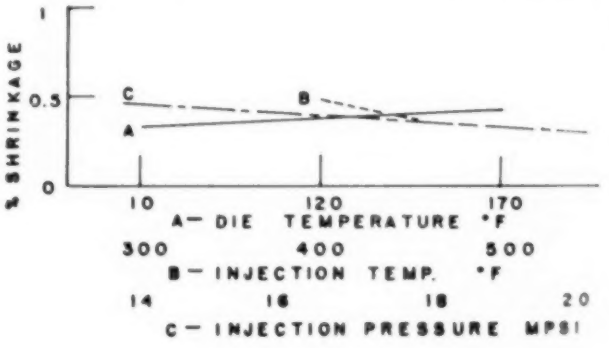
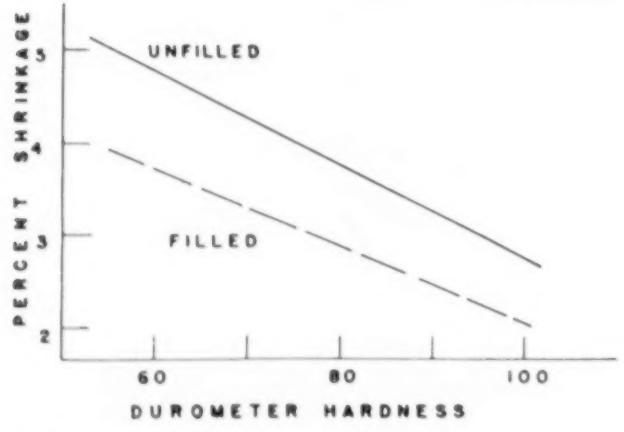


FIG. 7. NON-RIGID "VINYLITE" MOLD SHRINKAGE VS. HARDNESS

(Bakelite Co.)



effect. A decrease of 4000 psi increases the shrinkage by 0.001" per inch, which is considerable in proportion to the total shrinkage of methyl methacrylate. A decrease of injection temperature by 50 F. increases shrinkage by 0.001" per inch. Decreasing the rate of injection from fastest to slowest may increase the shrinkage by 0.001" per inch.

Temperature of mold is of less importance as a factor in shrinkage than it is with nylon or polyethylene. An increase of 100 F. in mold temperature increases the shrinkage by 0.001" per inch.

A graphical description of the data mentioned above on one grade of methyl methacrylate is presented in Figure (6).

VINYL

One class of **rigid vinyl** molding compound exhibits the shrinkage of 0.1%. These materials should be mold-

ed with cylinder temperatures of 280-300 F. and mold temperatures of 100-110 F. and pressures in the range of 16,000-22,000 psi.

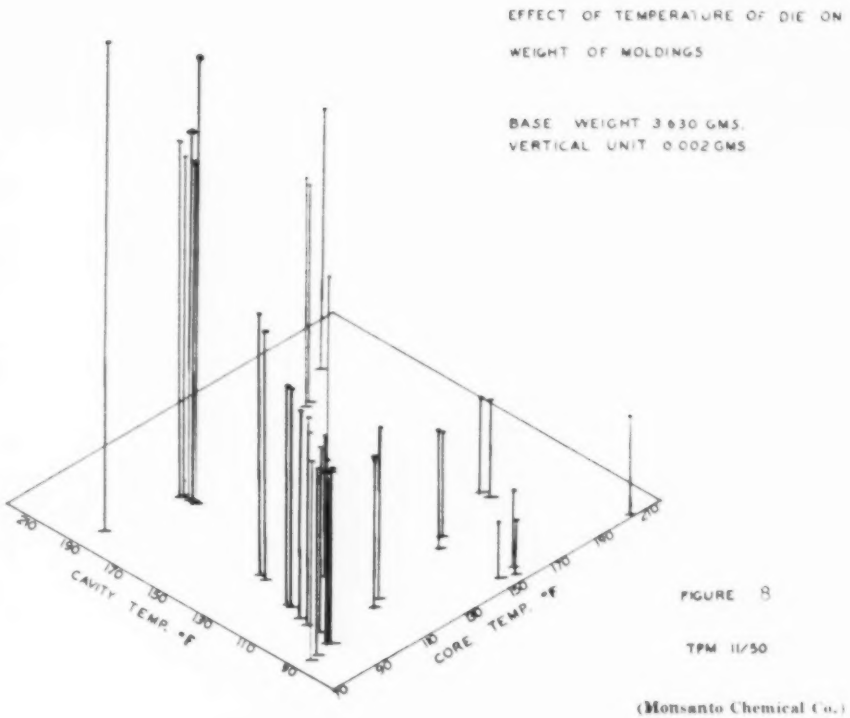
The **non-rigid** vinyl plastics exhibit shrinkage characteristics depending upon the formulation. Figure (7) shows the relationship between durometer hardness and percent shrinkage for unfilled and filled vinyl materials. The unfilled materials were run with cylinder temperatures of 320-330 F. The filled materials were molded with cylinder temperatures of 340 F. for durometer hardness 60; 350 F. for durometer hardness 70; 370 F. for durometer hardness 80; and 380 F. for durometer hardness 90. Mold temperatures were maintained at 100-110 F.

STYRENE PLASTIC

One company investigated the effect of die temperature on shrinkage. For this work, a cup die was used. The cavity side of the die contained the gate and runner. In order to obtain a more accurate indication of the effect of die temperatures, the results were measured in terms of weight changes.

Figure No. (8) is a three dimensional presentation of the effect of temperature of the die on the weight of moldings. The base platform represents die temperature, while the relative height of the vertical lines represent the comparative weight of the moldings—as a function of die temperature. Each vertical unit is equal to 0.002 grams increase in weight over a base weight of 3.630 grams. From figure No. (8) it can be seen that increasing the cavity temperature with constant core temperature results in heavier moldings. The colder the core temperature with increasing cavity temperature, the heavier the moldings. The reasons for this are felt to be twofold: (1) Since the runner and gate of the die are in the cavity side it is felt that the warmer the cavity side, the longer the gate and runner will remain molten, thereby allowing longer flow into the cavity before seal-off occurs; (2) The colder the core, the more shrinkage about the core; thereby creating additional space for incoming plastic.

The higher the core temperature, the lighter the molding, and the colder the cavity temperature with increasing core temperature, the lighter the moldings. The reasons for this are thought to be: (1) The colder the cavity temperature the more rapid does seal-off of the gate and runner occur, and (2) the higher the core temperature the less is the shrinkage of the plastic about the core. Increasing the temperature of both halves of the die simultaneously, which is represented by the diagonal line starting at the front corner of Figure (8), results in slightly heavier moldings,



(Monsanto Chemical Co.)

which indicates that the increase in flow through the gate and runner at the higher temperatures more than compensates for the loss in shrinkage about the core. Obviously, the heavier the molding, the less the shrinkage, and the more exactly the molding approaches the cavity dimensions.

Sealing Pressure

Another investigation of factors affecting mold shrinkage indicates that the sealing pressure is a most important factor. The "sealing pressure" is the pressure remaining in the cavity at the instant the gate freezes. As seen in Figure No. (9), shrinkages varying from .002 to .009 inches per inch can be obtained when the sealing pressure varies from 9000 to 1000 psi, respectively. The sealing pressure in turn is influenced by a number of factors, one of the most important of which is the plunger forward time. It can be seen from Figure No. (10) that with a five second plunger forward time, the sealing pressure is 1000 psi and as the plunger forward time is increased to 17 seconds, the sealing pressure is 9000 psi. The injection pressure also influences the sealing pressure, and accordingly affects the mold shrinkage. Increasing the machine pressure from 12,300 psi to 17,300 psi, caused an increase in sealing pressure of 3,100 psi. Increasing the injection temperature from 405 F. to 430 F. caused an increase in the sealing pressure of from 3,400 psi to 4,300 psi.

Mold temperature also plays an important part in sealing pressure, and consequently shrinkage. Increasing the mold temperature from 85 to 133 F. decreases the sealing pressure

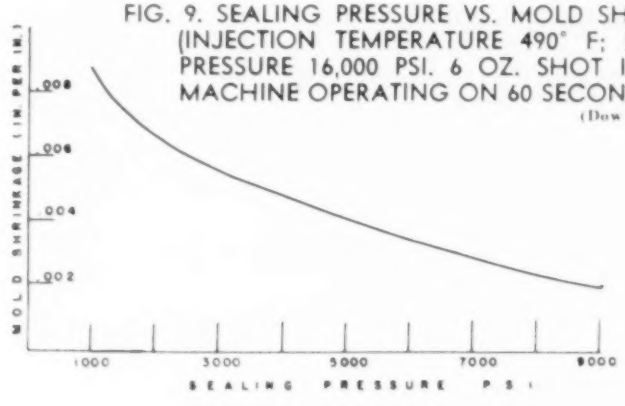


FIG. 9. SEALING PRESSURE VS. MOLD SHRINKAGE (INJECTION TEMPERATURE 490° F; MACHINE PRESSURE 16,000 PSI. 6 OZ. SHOT IN 12 OZ. MACHINE OPERATING ON 60 SECOND CYCLE.)

(Dow Chemical Co.)

from 5,400 to 3,400 psi. Inasmuch as the higher the sealing pressure the less the mold shrinkage, it can be seen that one advantage of operating with cold molds is reduced mold shrinkage. However, for other reasons, such as surface marks, the higher mold temperatures may be desirable. In order to produce satisfactory parts with the high mold temperature, it then becomes necessary to operate with longer cycles.

Another factor which influences dimensional tolerances of styrene plastics is **thermal expansion.** Changes in temperature are the cause of such dimensional variations. The coefficient of thermal expansion of styrene is 0.000045" per degree F. In a piece 49¼" long this amounts to approximately 0.0002" per degree F. Therefore, if the piece is molded so that its length is exactly 49.250" at some specified temperature, say 75° F., its length will remain within the allowable limits only as long as its temperature is between 69° and 81° F. This condition is illustrated graphically in Figure 11 by actual measurement taken on the above described piece. Therefore, it becomes rather obvious that it is necessary to specify a reference temperature at which the parts are to be measured if close tolerances are to be maintained.

FIG. 10. MOLD PRESSURE CYCLE INJECTION TEMPERATURE 490°F MACHINE PRESSURE 16,000 PSI. (6 OZ. SHOT IN 12 OZ. MACHINE OPERATING ON 60 SECOND CYCLE).

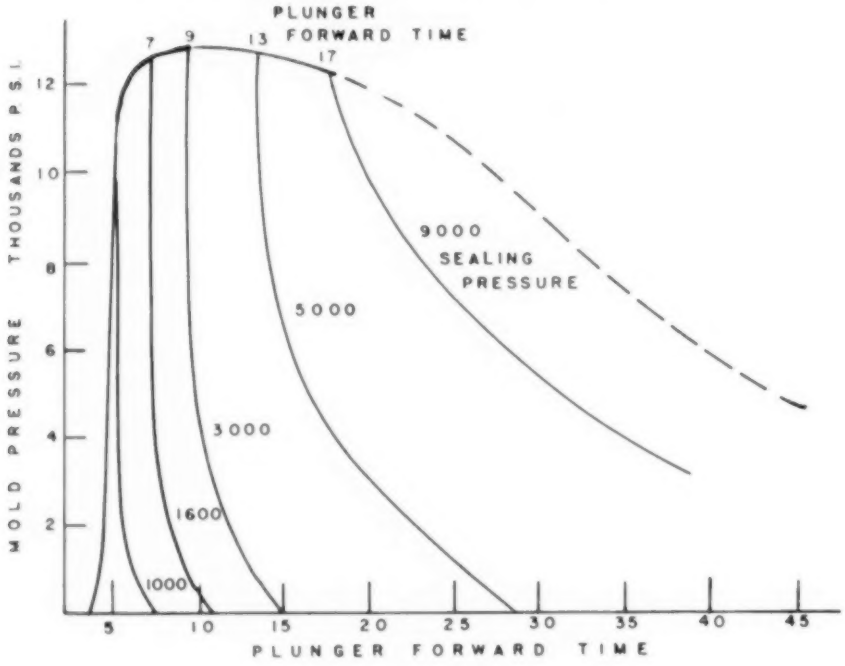
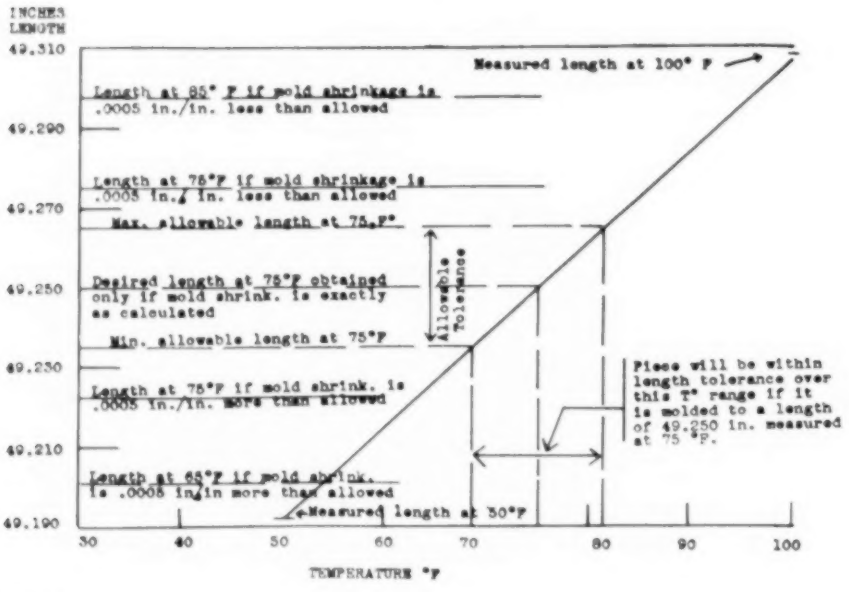


FIGURE 11.


INCHES
LENGTH
49.310
49.290
49.270
49.250
49.230
49.210
49.190
Measured length at 100° F
Length at 85° F if mold shrinkage is .0005 in./in. less than allowed
Length at 75°F if mold shrinkage is .0005 in./in. less than allowed
Max. allowable length at 75°F
Desired length at 75°F obtained only if mold shrink. is exactly as calculated
Min. allowable length at 75°F
Length at 75°F if mold shrink. is .0005 in./in. more than allowed
Length at 65°F if mold shrink. is .0005 in./in more than allowed
Allowable Tolerance
Piece will be within length tolerance over this T° range if it is molded to a length of 49.250 in. measured at 75°F.
Measured length at 50°F
30
40
50
60
70
80
90
100
TEMPERATURE °F

Another factor which influences dimensional tolerances of styrene is that of shrinkage with age. **Age-shrinkage** may be attributed to the fact that styrene plastics do not reach volume equilibrium in a short period of time at room temperature. the hot styrene piece is cooled so rapidly in the mold that the polymer chains do not have sufficient time to become as closely packed as they would under the thermal contraction law. When cooled, the material viscosity is so great that further shrinkage is severely hindered, but apparently continues.

This phenomenon has been noticed in the past by a slight continuous shrinkage over a period of time. Such a shrinkage appears to be independent of, and to occur after, the mold shrinkage. The magnitude of age shrinkage is to some extent a function of the design of the piece and the molding conditions which are dictated by this design. This shrinkage is most noticeable during the days or weeks immediately after molding. Its rate diminishes with time, and in most cases becomes almost negligible after a period of approximately 30 days. The age shrinkage for one type of general purpose styrene and one type of high impact styrene is presented

Figure 11 also illustrates how a very slight miscalculation of mold shrinkage can further complicate the picture. For instance, if the mold shrinkage is 0.0005" per inch greater than calculated, and the pieces measured at a temperature of 65° F. rather than 75° F., the piece is approximately 0.050" shorter than the desired length, and approximately 0.035" below the allowable tolerance.

It should be emphasized here that the conditions described in Figure 11 are for a very narrow range. It is not reasonable to expect to be able to predicate mold shrinkage within less than .0005" per inch on a wide variety of applications. The variation is more likely to approach plus or minus .001" per inch. The pieces also encounter much greater temperature changes than those indicated. At 0° F. the length of the piece which is 49.250" at 75° F. is 49.077". At 150° F., its length is 49.23", a variation of plus or minus 0.173".

Age Shrinkage

ure 12. This data was obtained from measuring samples at room temperature and shows that most of this type shrinkage occurs within the first 25-30 days. At the end of 100 days, the age shrinkage values obtained on .5" tensile bars are approximately 0.005" per inch for either Styron 475 or 666 at room temperature.

Molding conditions can affect age shrinkage of general purpose styrene by as much as plus or minus 18 per cent and for one type of high impact styrene by as much as plus or minus 13 per cent. At the moment, the effect of different molding conditions is not clearly understandable from existing data. However, additional work is being undertaken on this point.

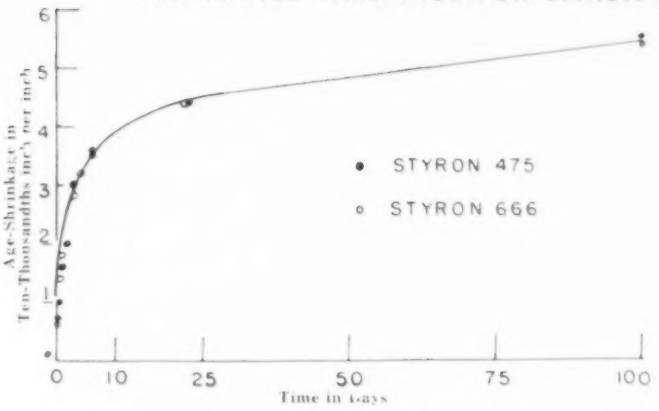
Annealing of molded pieces has a pronounced effect on the age shrinkage. When the samples of general purpose styrene were annealed, an immediate shrinkage amounting to three times that of the hundredth day unannealed specimens results. For one type of high impact styrene, an immediate shrinkage of eight times over that of the hundredth day unannealed specimens occurs due to annealing. This information was obtained from the data presented in Table 1.

Styrene Aging

Tests are being continued on the age shrinkage of styrene molding for a year or longer if necessary. Nevertheless, from the data obtained to date it would appear that this factor is not as important as the other two factors which contribute toward dimensional tolerances; namely, mold shrinkage and thermal expansion. For all practical purposes on ordinary applications, the dimensional change in styrene moldings over a period of time is so small that it may be neglected. However, on applications demanding close dimensional tolerances, it may be of sufficient magnitude to be an important factor. In such cases adequate allowances for this factor are imperative. It should be realized that the age shrinkage of styrene is small when compared to other common thermoplastic materials. For example, the dimensional change of ethyl cellulose under similar exposure conditions may be four to five times as large while the figure for some cellulose acetate formulations may well be of the order of ten times as large as that of styrene.

The recent introduction of high impact styrenes to the class of thermoplastic molding materials also bears investigation from a mold shrinkage viewpoint. Experience to date indicates that the mold shrinkage for the high impact types of styrene is greater than that for general purpose styrenes by as much as 0.0005-0.002" per inch.

FIG. 12. AGE SHRINKAGE FOR STYRON (LINEAR)



CONCLUSIONS

In conclusion, it can be seen that there are a number of factors which play an important part in determining the mold shrinkage of various thermoplastic materials. Through the proper control of these factors, it is possible to arrive at a precise figure for mold shrinkage. Once the exact molding conditions are arrived at, they must be standardized if precision parts are to be obtained. This pertains not only to the factors described previously, but it also applies to the overall cycle. The length of time the die remains open must also be constant from one shot to another.

If accuracy of dimension is required, it is essential that a range of molding conditions be tried so that shrinkages in the several dimensions can be measured. Once this is accomplished, it is then possible to select the molding conditions which give the desired dimensions. Another approach is to construct trial cavities which are undersized, with pins oversize, so that they may be machined to the correct size after the shrinkages have actually been determined by making moldings in them.

As for predetermining shrinkage, certain established principles can be followed. With the exception of the cellulosics, all the other thermoplastic materials obey the following rules:

1. The greater the plastic temperature the less the shrinkage. This is a consequence of more effective pressure being transmitted into the cavities by keeping the gates and runners open longer and also permitting faster flow into the cavities.

2. The greater the injection pressure the less the shrinkage.

3. The higher the die temperature the greater the shrinkage.

4. Multiple gates reduce shrinkage.

5. Smaller gates and runners increase shrinkage.

6. Short mold closed times give increased mold shrinkage and vice versa.

7. After-mold shrinkage, or age-shrinkage, occurs with thermoplastics. The degree depends on the particular material involved.

The cellulosics follow all the above rules except #1 (effect of temperature on mold shrinkage). Here, the thickness of the piece and the type of plasticizer formulation involved determines whether higher injection temperatures produce greater or less mold shrinkage. Also, weight loss due to plasticizer volatilization must be considered.

In an effort to reduce finishing costs, molders are increasingly resorting to restricted and single gates. Such a condition results in increased shrinkage. Also, the desire to operate near the clamping capacity of a machine causes uncertain shrinkages. Through the use of multiple gates and the allowance of adequate clamping, a more precise control on mold shrinkage can be obtained. Also the use of standardized and selective molding conditions is another means of arriving at the desired mold shrinkage.

The injection molding process is rapidly being removed from the realm of an art into one of a science. Although the rapid expansion of the injection molding industry has been one based mainly on trial and error, the present day and future requirements necessitate the application of scientific principles. Once these principles are established, the true factors controlling quality and precision can then be easily regulated.

RECOMMENDATIONS

In view of the fact that dimensional tolerances involves factors of mold shrinkage, thermal expansion and age-shrinkage, molders should keep the following considerations in mind if reasonable dimensional accuracy is to be obtained:

1. Adequate tolerances must be allowed to accommodate the variations in mold shrinkage which are likely to occur.

2. Adequate provision must be made in the design of the assembly to accommodate any thermal expansion

and contraction which may occur prior to and after installation.

3. Provision should be made to accommodate whatever age-shrinkage occurs.

The information presented above by no means explains fully all of the variables associated with shrinkage. A great deal more work remains to be done to explain all the results obtained, and eventually to be able to specify conditions for a specific molding job. In addition to the usual molding variables previously explored, it would be desirable to have a nozzle shut-off, means of continually obtaining stock temperature, and means of controlling ram speed, among others, available for a more comprehensive investigation. It is trusted that such an investigation will be undertaken within the near future.

ACKNOWLEDGEMENTS:

This report has been written in an attempt to present more concrete information on one of the most important topics associated with injection molding; namely, mold shrinkage. From actual experience in the field it has become obvious that the need for such a presentation exists.

In preparing this report, many of the foremost individuals on injection molding were contacted. The author is greatly indebted to all those who have contributed their generous time and assistance. Particular appreciation is expressed for the services rendered by:

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W. Gobeille, Nash Kelvinator Co., Inc.

L. W. A. Meyer, Tennessee Eastman Corp.

W. C. Austin, Bakelite Div., Union Carbon & Carbide Corp.

R. L. Stern, H. C. Wain, and A. R. Olson of the Hercules Powder Co.

J. Goulka of the Santay Corp.

Sherwood L. Young, C. F. Church Mfg. Co.

O. Morningstar, of the Morningstar Corp.

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GOLDEN GATE ENJOYS FORUM

The April 26th meeting of the Golden Gate Section convened at 6:40 at the El Jardin Restaurant with President Joseph Smith presiding.

The program committee had arranged, for the evening, a forum in which all members took part, led by local leaders in their various fields. Leading the discussions were: Lloyd Griffith, mold building; Robert Romo, mold problems, Joseph Smith, laminating, John Robb, mold design, Richard Weber, mold engraving. Under the very able chairmanship of J. R. Ackers, who served as moderator, an exceptionally spirited and educational evening was the reward for those attending. Place cards collected afterwards had many favorable comments, some requesting more programs of the type.

The excellence of the steak dinner came in for a share of appreciation.

Eighteen members and three guests were present. Mr. S. W. Lohman, Cleveland Section, was a visitor also.

LABOR COUNSEL SPEAKS AT CHICAGO ON LAW OF LABOR RELATIONS

By Tim Serrell

Dr. Benjamin Werne of New York, Special Labor Counsel to the SPI, gave all those who attended the April 11th combined meeting of the SPE and SPI an authoritative, informative and inspirational message concerning "Employee Relations in an Arsenal Economy."

Dr. Werne, the author of "The Law of Labor Relations," has prepared a "Supervisory Program" which is obtainable for members of the SPI by writing Bill Cruse, Executive Vice-President of SPI, 67 West 44th St., New York 18, New York. This educational program was designed to help attract people toward management and not thrust them away.

Mr. M. Meltzer of Service Plastics, Inc., SPE chairman of the golf committee, announced the golf outing dates and locations for the joint SPE-SPI summer golf tournaments:

Friday, June 15th—River Forest Golf Club, Elmhurst, Illinois; Tuesday, July 24th—Rolling Greens Country Club, Arlington Heights, Ill.; Friday, August 17th—River Forest Golf Club, Elmhurst, Illinois.

Our golf chairman proudly advised that a fourth child, Niel Meltzer arrived at his household February 24, 1951.

Our program committee wants to stress that our meetings are always held the second Wednesday of the month at the Builders' Club, 228 No. La Salle St., Chicago, Illinois.

For the May ninth meeting a representative of the Manco Company of Detroit, Michigan, had for his subject "Why Beryllium Copper?"

"Uses of Fiberglas in Molding" was the other topic scheduled to be given by Mr. Bushman of the General American Transportation Corporation.

Following their spring meeting held in Chicago May 9, 1951, the National Directors of the SPE attended the Chicago Chapter meeting that evening at the Builders' Club.

For our June sixth meeting the SPE program committee is planning a symposium, topics to be announced later.

Aside from the golf dates listed above, the June meeting will be the last until September.

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The Quartermaster Corps Interest in— *Plastics*

By Charles N. Gardner

Quartermaster Corps, Plastics and Chemicals Division

Items and materials ordered by the Quartermaster corps are listed, and the proper addresses to write to for information are given.

A specification usually consists of three elements: the technical requirement, the inspection requirement and the packaging requirement. In its technical aspect, the specification can be thought of as the final report on a research and development project. We strive to write specifications which set forth clearly and accurately the minimum needs of the Quartermaster Corps in such a manner as to admit all bidders to compete on an equal basis. Further, every effort is made to write specifications which permit the widest possible acceptance of commercially available products.

I propose to discuss very briefly the technical requirements of the majority of our molded plastic items which are covered by specifications, as well as several important plastic items which are now in development status. If field and other tests prove the acceptability of the development products they will later be covered by specifications and authorized for procurement.

SPECIFICATION ITEMS: The following specification plastic items are probably better known to every one than others that will be mentioned later: **(a) plastic buttons** normally required on the garments we purchase are usually either phenol or melamine. Although in the majority of instances the garment producer must arrange for procuring the specified buttons, the QMC also buys plastic buttons required for its own needs, for example, for garments manufactured by the Philadelphia Quartermaster Depot. In any event, all plastic buttons must conform to the requirements of Federal Specification V-B 871a on buttons. **(b) Canteen Cap**—Made from a thermosetting molding material, such as phenol-formaldehyde with macerated cellulose fabric filler or a phenol-formaldehyde impregnated sheet material. The Izod requirement calls for a minimum of 0.8 foot-pounds per inch of notch. (c) **Plastic Spoons**—During the past year bids were requested for over 70 million injection molded polystyrene disposable spoons required with field rations. Except for the plastic spoon, very few of our needs specify polystyrene. (d) **Plastic Tableware**—Under a tentative specification we purchase rag-filled phenol-modified melamine-formaldehyde tableware items, principally for the Medical Service. However, we have a great interest in plastic tableware for Army-wide use and I would like to discuss this in detail a little later on. (e) **Sun Helmets**—A cloth covered resin-pulp construction is now specified. However, a molded modified styrene material, which appears promising, is being investigated for this application. (f) **Tent Windows**—Wire-reinforced cellulosic sheet stock (0.093" thick) is required for the 16' by 16' Insulated Frame Type Tent; vinyl film is used as a flexible glazing for the Command Post Tent and certain types of hospital tents. These items are procured both by the tent contractor and the QMC. (g) **Whistles**—The specification on plastic whistles specifies injection molded cellulose acetate butyrate or ethyl cellulose. It is planned that this specification will be revised shortly to allow additional commercially available designs.

Since the word "plastic" appears in the official nomenclature of each item in the next group, (as listed in the published specification index), these are not as likely to be overlooked by the plastic industry as the last group to be discussed. However, some of these we shall now mention have been procured but infrequently in the past few years: (a) **Plastic Combs**—Purchased under a Federal Specification which prescribes combs shall be molded from thermoplastic molding material. The comb, among other things, must maintain its shape when immersed for 30 minutes in water maintained at 160° F. (b) **Plastic Decoration Container**—Injection molded polymethyl methacrylate; the top is crystal clear, the bottom is translucent blue. (c) **Plastic Fireman's Helmet** — The present specification calls for a phenolic resin-impregnated fabric. However, a new specification now being prepared for publication has been greatly broadened so as to authorize additional plastic materials for the shell. The new specification prescribes that the plastic material for the shell shall be composed of a fiberous filler impregnated with a thermosetting resin. This change is typical of what is being done, whenever possible, to reflect current commercial practices. (d) **Plastic Machete Sheath**—Duck impregnated with vinyl resin and laminated between thin sheets of the same vinyl resin. (e) **Plastic Soap Box**—Injection molded polyethylene or ethyl cellulose. (f) **Plastic Six-Compartment Food Tray Liner** — Cellulose acetate sheeting 0.0075" thick.

The last group of specification plastic items to be mentioned are components of various end products; the word "plastic" does not appear in the title of the end item specification: (a) **Injection Molded Cellulose Acetate Butyrate or Cellulose Acetate-Buckles** are specified for Mittens, Over, White. (b) **Laminated phenolic sheet plastic and foamed urea-formaldehyde** are used in the manufacture of the Container, Food, Insulated, M-1944, With Inserts. (c) **Extruded polyethylene drinking tubes (sippers)** are used in the Ration Supplement, Special Item Pack, Hospital, and the Ration, Supplement, Special Item Pack, Aid Station. However, the zippers are usually purchased separately by the QMC and furnished to the ration assembler. (d) **Polystyrene, cellulose acetate and cellulose acetate butyrate** components are specified for certain sun glasses and or goggles; injection molded cellulose acetate butyrate or ethyl cellulose components are also specified for the Box, Match, Waterproof. (e) **Alpha-cellulose melamine and cotton-flock phenolic components** are specified for salt and pepper shakers.

DEVELOPMENT ITEMS:

PLASTIC TABLEWARE: After almost three years of field and laboratory testing, plastic tableware is being considered for adoption as a standard item for use in Army messes. In order to make possible the employment of a standardized line of tableware, which incorporates improvements suggested or recommended by our various field tests, we have designed a line of plastic tableware particularly suitable for Army-wide use. These items, all to be produced from mottled tan, rag-filled phenol-

modified melamine-formaldehyde, include a cup, a bowl, and a tumbler.

Other related melamine plastic tableware items which have been already procured or are currently under test are: 14 1/8" x 18" serving tray, 15¼" x 20½" serving tray, 5-compartment mess tray, and a 2½ quart water pitcher.

A newly proposed consolidated specification on plastic tableware has recently been circulated to interested industrial organizations for their comments.

REINFORCED PLASTIC: We have under development at present a number of reinforced plastic items. Most of these are produced from polyester resin and glass fibers. The following are typical examples: (a) **Typewriter Carrying Case:** This plastic case weighs 13½ pounds, which represents a reduction in weight of 13 pounds over the usual plywood case. (b) **Trunk Locker**—Molded in matched aluminum dies using polyester resin and glass mat; mat is preformed to shape prior to molding. The standard vulcanized fiber-plywood trunk locker weighs 39 pounds; this new one weighs 23 pounds.

Other reinforced plastic developments include structural parts for tents, arctic sleds, snowshoes, skis, shoe shanks and a packboard. In addition, consideration is being given to the development of a field desk from glass mat and polyester resin.

Under a purchase description we have procured 50,000 polyester-glass bread boxes (designed to hold 25 loaves of wrapped GI bread). This box weighs about 9 pounds—roughly 3 pounds each for resin, mat and hardware. A steel frame-work is incorporated to improve rigidity and strength; also included are stainless-steel nesting and stacking elements. A specification is now being prepared on this plastic bread delivery box.

FOAM PLASTIC: We are investigating foam plastics for two principal applications: (a) as an insulating material—requiring low K factor, stability at temperatures ranging from -80 F to + 175 F, non-settling characteristics, etc. (b) for 4' x 8' x 4" lightweight, mechanically strong panels needed for special structural purposes.

OTHER DEVELOPMENTS: Also under study or development at this time are the following plastic items: (a) clear transparent tumblers (b) polyethylene snow rings and handgrips for ski poles (c) shoe heels (d) fibrous filled thermosetting molded replacements for tent hardware (e) improved thermoplastic tent windows (f) higher impact strength phenolic buckles, (to improve the present buckle, slide, phenolic, brown, 2¼") (g) modified styrene cap visors and (h) expanded polyvinyl chloride hat grommets.

Copies of specifications covering items we procure may be obtained from the Specification and Quality Control Section of the Philadelphia Quartermaster Depot. You may also be interested in obtaining from the Superintendent of Documents at Washington, D. C., a copy of "Index of Specifications (Including Military (MIL and JAN) Standards), Department of the Army." The price is $1.50 a year, which includes monthly supplements. An examination of the QM exhibit at the New York Purchasing Office will also give you further information on where plastics are used.

If you are interested in bidding on production quantities of plastic items, it is suggested that you communicate with the New York QM Purchasing Office at 111 East 16th Street, New York City, and with the Chicago QM Purchasing Office at 1819 West Pershing Road, Chicago, Illinois, and advise them of your desire to supply plastic items to the Quartermaster Corps. A booklet entitled "How to Sell to the United States Army," which may be obtained from the Superintendent of Documents for thirty cents, will give you details on what these offices purchase as well as purchase information relating to other branches of the Army.

A drafting of a specification is a difficult assignment and it is not always possible to write one entirely free of criticism. It has often been said that a perfect specification has yet to be written. Since industry is a most important member on our team, we particularly urge you to critically and carefully review any proposed specification which is of interest to your organization. I can assure you that your comments are of prime consideration to any specification writer. If we do not receive your criticism we naturally assume that either you have no interest in the item or that you are in complete agreement with the draft. We are glad to include in the industry coordination group any organization that expresses an interest in participation.

As you well know, it is virtually impossible to keep up with all of the latest developments in plastic materials, processing and molding techniques, equipment, application, etc. As you are technical experts in your particular fields in the plastics industry, your comments and suggestions relative to our work are most welcome at any time.

TOLEDO NEWS

By R. E. Wagner

The Toledo Section of S.P.E. met March 21, 1951 at the Toledo Yacht Club. Following a fish dinner, President Eric Kohler opened the business meeting.

Mr. James Summers (Detroit District Representative of the G. E. Chemicals Department) discussed the physical properties and the very excellent impact characteristics of rubber filled phenolics. Mr. Summers' talk was highlighted with slides, movies and molded samples.

The next meeting was held Wednesday April 25, 1951, 8:00 p.m. at the Owens Illinois Club Room located at Dorr and Westwood. Mr. A. J. Wiltshire of Apex Electrical Mfg. discussed the progress of his company in fabricating and using polyester-glass washing machine parts.

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MIAMI VALLEY HEARS REN MORSE ON INJECTION ACCESSORIES

By John L. Russell

The May meeting of Miami Valley Section was set back to May 17 in order to accept an invitation to tour the plant of the Dayton Rubber Co. Members met for dinner at Neil's Restaurant, S. Dixie Ave. at 6:30 p.m. The program chairman for this affair was Carroll Jensen.

Approximately 60 men, including a number of guests from Recto Molded Products, Inc., Formica Insulation Co., Crosley Div., Avco. Corp., Cincinnati, O. and the Buckeye Molding Co., Miamisburg, O. attended the dinner meeting on Thursday, April 6 at the Eaton Manor, Hamilton, O. Ralph Backscheider was program chairman and really did a whomping good job in lining up such a large number of guests and potential members. The principal speaker was A. R. Morse, Injection Molders Supply Co., Cleveland, O. Ren, in his own familiar way related the problems associated with the injection molder and some of the development work carried on by his company in making available for the trade purger materials, silicone greases as lubricants, liquid stearates, dry coloring of molding powders, etc. He also brought forth some of the features of a new type cylinder developed for injection molding and emphasized the need of better die temperature control.

Dr. Jesse H. Day was a surprise visitor and upon introduction by President Martin Kasch, responded by urging the members to participate in the SPE Prize Paper Contest, with $200, $100 and $50 prizes. The subject matter may be Materials, Molding Process, Machinery, Process Control, Financing, etc. Originality is the only requirement, he said.

Plans are underway for the annual summer picnic to be held again at the Terrace Park Country Club, Cincinnati in June. This will close Miami Valley's activities for the present season.

President Kasch has distributed new membership rosters to all of the members. Roy Dean, formerly with Kurz-Kasch Inc., as Works Manager, has transferred to the Detroit Section.

HANDLING PLASTICS PROBLEMS IN THE ORDNANCE CORPS IS NEW YORK TOPIC

By Arthur M. Merrill

A talk on "Handling Plastics Problems in the Ordnance Corps" featured the April 18 dinner meeting of the New York Section, held at the Hotel Shelburne with some 65 members and guests attending. The paper was presented by William Powers, Picatinny Arsenal, Army Ordnance Corps, substituting for the scheduled speaker, Dr. Lucius Gilman, who was unable to attend owing to illness.

After reviewing the scope of products handled by the Army Ordnance Corps, Mr. Powers noted that the use of plastics in ordnance is increasing at a steady rate. Army Ordnance research and development work on plastics is handled at the plastics laboratory at Picatinny. The speaker described the organization of the laboratory, its facilities, and its work in testing plastics to determine their suitability for use in ordnance equipment. A spirited discussion followed the talk as the speaker answered questions from the floor on engineering and procurement problems encountered by the plastics industry under ordnance contracts.

Section president George Baron, Ideal Plastics Corp., presided over the meeting, and the speaker was introduced by the program chairman Winslow A. Ward, American Cyanamid Co. Table favors were distributed through the courtesy of Dusal Tool & Mold Co., and the meeting closed with a drawing for door prizes contributed by Brilhart Plastics Corp., Celanese Corp. of America, and Wess Plastic Molds, Inc. The door prizes were won by Nicholas Klein, Injection Molding Corp.; Irvin I. Rubin, Robinson Plastics Corp.; and Mr. Ward.

Four new members were added by the Section during April, as follows: Warren T. Bushman, technical representative, Bakelite Division, Union Carbide & Carbon Corp.; Irvin I. Rubin, vice president, Robinson Plastics Corp.; Jorge I. Slachevsky, plant manager, Plastix Peruana S.A., Lima, Peru; and Benjamin Stopek, mold design engineer, Ideal Plastics Corp.

The next regular meeting was held on May 16 at the Hotel Shelburne. Speaker of the evening was E. O. Clark, Vickers, Inc., Division of Sperry Corp., who discussed "Today's Problems of the Plastics Engineer."

The last regular meeting before the summer recess will be held on June 20 at the Gotham Hotel. This meeting will feature a talk on "Large Injection Presses" by Frank Helander, Watson-Stillman Co.

Section Notes

Buffalo

On April 20 the Buffalo Section held a round table discussion on "Quality Control as Related to Plastics Fabrication." It was led by G. V. Delaire, John Russner and Tyler Hawkes of Eastman Kodak Co.

Connecticut

Mr. Ed Borro, Durez Plastics and Chemicals, Inc., and Mr. Islyn Thomas, Thomas Mfg. Co., and national president of SPE, discussed transfer molding at the April 13th meeting of the Connecticut section.

At the April 11th Board of Directors meeting the following committeemen were chosen for the Connecticut section: Program—E. Seim, W. Smith and A. Wargo; House—M. Greenhalgh, two assistants to be appointed; Membership and Credentials—David Messenger; Publicity—David Mersey.

E. New England

On April 26, the Eastern New England Section heard Mr. E. D. Kennedy of Monsanto Chemical Co. discuss "Selling Plastics to the Government." He discussed how to build sources of information, where to find prime contractors, how to obtain specifications, how to crack the circle of negotiated bidding. Mr. John Kavanagh discussed "Basic Rules of Thumb in Mold Design."

Philadelphia

On April 24, Mr. W. J. B. Stokes II, president of Stokes Trenton, Inc., talked on "Problems in the Construction of Large Injection Molds" at the joint SPE-SPI meeting in Philadelphia. The film "From the Ground Up," which concerns the petroleum industry, was also shown.

Quebec

Dr. Earle S. Ebers, Naugatuck Chemical Div. of United States Rubber Co., discussed "Polyesters" at the April 19th meeting of the Quebec section. The Quebec Rubber and Plastics Group and the Quebec SPI met with the section.

Rhode Island

Mr. W. G. Connelly discussed the Bakelite Divisions methods of producing thermosetting and thermoplastic materials, especially rigid vinyl sheets at the May 9 meeting of R. I. & S. E. Mass. The discussion was illustrated by slides.

Rochester

Mr. Richard R. Hydeman, Dow Chemical Co., spoke on "Recent Research in Injection Molding" at the April 16th meeting of the Rochester section. Due to the large advance reservations, the meeting had to be moved from the Clintonaire Restaurant to the Liederkranz Club.

Klippings From Kosy

By Walter Kosy
Chrysler Corp.

Your reporter was unable to attend the last dinner meeting of the Detroit section of the SPE, having been laid-up with what seemed to be the flu combined with maleguania but from all reports the members attending had an educational and interesting evening. The meeting was held at the Harmony Club in downtown Detroit to give the members a change of scenery, and Mr. Jack Leyden of the Crucible Steel Company was the speaker. Mr. Leyden's talk was on the subject of "Steel for Plastic Molds."

At a recent meeting of the Board of Directors, Roy Lyon, owner of the Lyon Design Co., 22087 Michigan Ave., Dearborn, Mich., was made a Director of the Detroit section. Roy has been active in the Detroit section for several years, currently serving as House Chairman of the Program Committee. He has been in business for himself for almost a year after working as a mold design engineer for various firms in the Detroit area.

Most recent addition to the crew at Lyon Design is James Babin who was taken on to handle the steadily increasing business of the company. Jim Babin's last previous connection was as design engineer with the Detroit Designing Service.

Mr. Bill DeGalen's attention is earnestly called to the fact that Jim Babin's name is not yet listed in the Detroit SPE membership roster.

Incidently, while we are on the subject, prospective members for the SPE in Detroit can get application blanks by contacting Bill DeGalen at the Koppers Chemical Co. office in Detroit. Just call Woodward 3-3396 and have him send you an application.

Members of the Detroit section will again have an opportunity this year to contribute to the progress of plastics technology and receive due recognition and cash prizes for their efforts. We refer to the recent announcement by the National SPE of the annual Prize Paper Contest. National prizes are $200, $100, and $50 for the three best papers submitted.

The Board of Directors of the Detroit section voted recently to award special local prizes of a $50 Savings Bond, a $25 Savings Bond, and a $10 book on plastics as 1st, 2nd, and 3rd prizes respectively for the three best papers submitted from the Detroit area. The best paper will then be submitted to the national contest.

Al T. Look, of the Dow Chemical Co., Midland, Mich., has been appointed to the staff of Dr. Ray H. Boundy, manager of the plastics division of the Dow Chemical Co., it was recently announced. He will serve as co-ordinator of raw materials and plastics production. Grant W. Cheney will succeed Look as head of the extrusion molding division.

Keep July 10 an open date on your calendar. This is the date that has been set for the SPE annual golf party. This year it will be held at the Meadowbrook Golf Club and a big time for all is planned. More details will be released in the near future.

Tenite Pipe For Oil Is Described At Newark Meeting

By John Groesbeck

The April meeting of the Newark chapter of the Society of Plastics Engineers was held on Wednesday April 11th at the Military Park Hotel. Approximately 80 members and guests including N. Y. City chapter members attended.

The business meeting was featured by the announcement by Islyn Thomas, National President, that Edward Rowan had been appointed National Committee Chairman in charge of evaluating technical speeches. The door prize was donated by Genloid Corp. and won by Al Kaufman of Industrial Synthetics.

The first speaker, Mr. Louis Connelly of the Tennessee Eastman Corp., gave an interesting talk on the history of Tenite pipe applications in oil country. The oil producing area of the state of Kansas was selected for the initial tests in 1949, the first installation being a 3" pipe line for disposal of the salt water incidental to the recovery of oil. This 800 foot installation is still in service plus an additional 100,000 feet of pipe. Tenite pipe was first considered as a replacement for cement-lined steel pipe and transite lined steel pipe. One of the problems in connection with oil country production was the tendency of the paraffin particles in oil to deposit on the pipe wall. Eventually the pipe was so clogged as to require disassembly and cleanout. Another problem was the corrosive action of salt earth, salt water and sour crude oil on ordinary metal pipe, requiring replacement in a few weeks' time. The use of heavy-wall Tenite pipe in 3" and 4" diameters has solved these problems. The pipe is delivered to the point of installation in 20 foot lengths, on one end of which has been cemented an injection-molded threaded coupling. Assembly of 4000 foot lengths is made by the use of ordinary strap wrenches and a block and tackle.

Dr. Russell Akin of the Du Pont Company was the second speaker. A short film was shown on the subject of ASTM tests on plastics, followed by a discussion on their relative values.

The June meeting will consist of an outing to a country club in the Newark area. Golf and tennis will be the main attractions.

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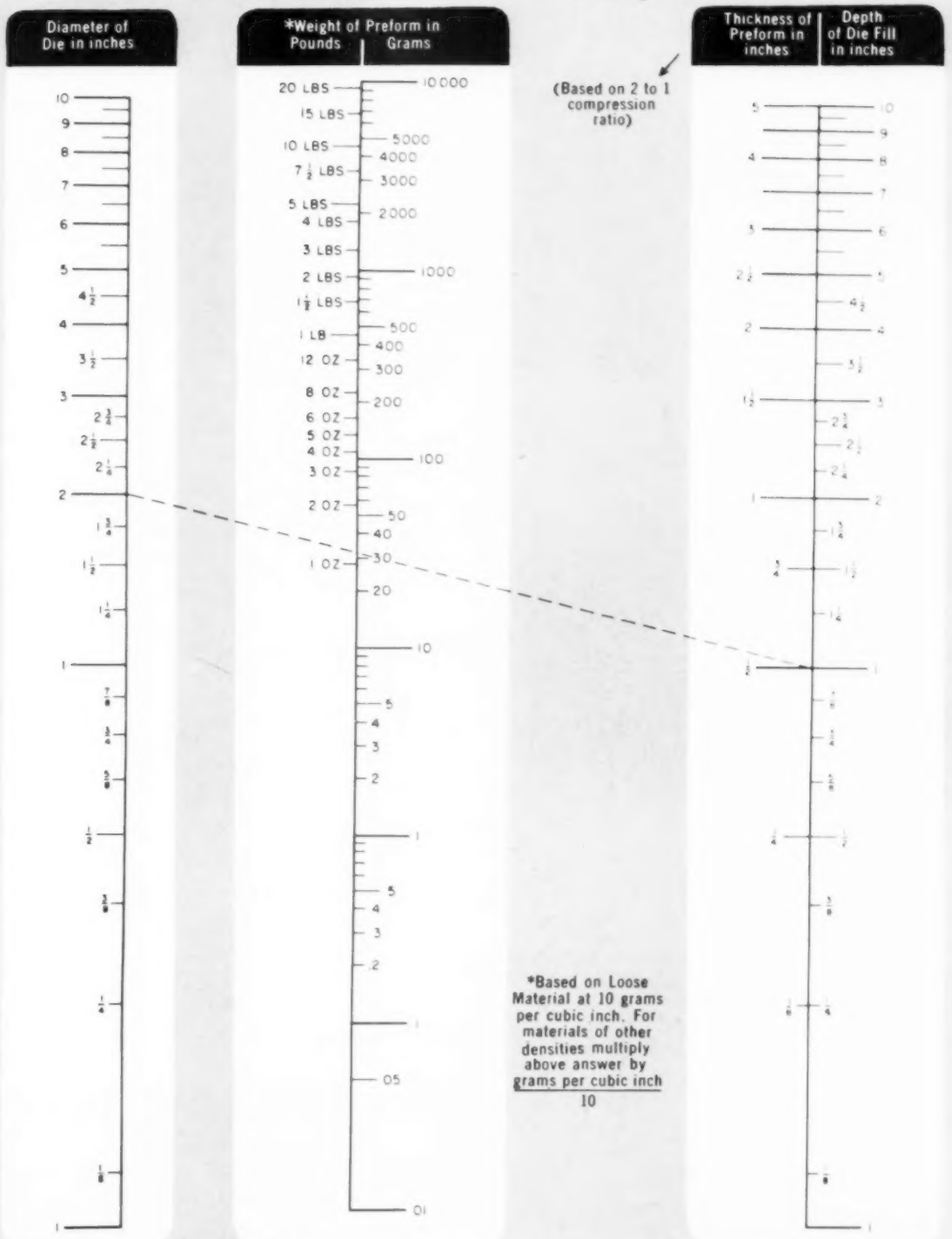

To assist plastics molders who use preforming presses, this chart is a ready calculator. Briefly, if the diameter of a die is 2" (left scale), and the weight of the preform is to be 31 grams (middle scale), based on loose material at 10 grams per cubic inch, then the depth of fill will be 1 inch (right scale). For materials with densities other than 10 grams per cubic inch, divide the answer from the chart by grams per cubic inch and multiply by 10.

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Your name and address as listed above is the way it will appear in the June membership roster. Please notify editor of any changes or corrections.

UPPER MIDWEST TOPIC 3-M RESEARCH

By D. H. Chambers

Mr. Gordon Hollingsworth of Minnesota Mining and Mfg. Co., Detroit, gave us another look at 3M by his very interesting discussion of adhesives and coatings. It appears that with many new developments in this field, there are no limitations on what can be bonded to what. Some of the applications discussed and illustrated were bonding of rubber to metal, metal to wood, metal to metal, as well as many coatings. One particular coating is used to protect painted metal surfaces so that they may be formed without damage to paint. Heavy cabinets assembled of wood and metal are held together by adhesives alone—this gives an idea of the terrific strengths that can be obtained. In many cases adhesive bonding can be many times stronger than conventional mechanical fasteners and less costly.

3M, through their tremendous research departments, offers a service to fabricators which is unequaled.

New members — We take great pleasure in welcoming three new members to the Section: Lennert I. Johnson of Minneapolis-Honeywell Regulator Co., Frank P. Seidl of Plastics, Inc., and Paul A. Bury of Winona, Minn. Mr. Bury is a transfer from the Miami Valley Section. We certainly hope you fellows will enjoy and value your membership.

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TRANSFER MOLDING AT ST. LOUIS

By Dan Otto

On April 24th the St. Louis Chapter of the Society of Plastic Engineers had their regular monthly meeting and we had as our speaker, Mr. E. F. Borro, Jr. of the Durez Plastics & Chemicals, Inc., North Tonawana, New York.

He read a paper on "TRANSFER MOLDING" which was the result of a long program of research by the Durez people. This illustrated the function of the various types of round, square and rectangular gating, and showed the relative advantages of each method.

He also covered "Tubular Insulation" as related to the Plunger Molding method.

The entire talk was well illustrated with a series of slides and was well received by the rather large turn-out of members.

BUSINESS ADVICE GIVEN AT TEXAS

By M. A. Arthur

South Texas plastics businessmen were ably represented at a special Houston meeting of the U. S. House of Representatives' Select Committee on Small Business, May 3, 1951. Committee members present were Hon. M. Mansfield, D. Montana, Hon. T. B. Curtis, R. Missouri, their counselor, and assistants. In addition, the U. S. Navy, U. S. Air Force, the NPA, OPS, ECA and RFC were represented.

Mr. George S. Nalle Jr., President of Nalle Plastics, Inc., Austin, Texas was the first witness and presented testimony that "Small business faces annihilation for lack of steel." He was referred to the NPA member of the Panel and was given immediate assistance.

Mr. Joseph S. Finger, President of Corrulux Corp., Houston was next and presented evidence of the detrimental effect of the excess profits tax provisions on new small businesses formed since 1947. The committee complimented him for a well prepared statement and stated that they would use it for argument before the U. S. House Ways and Means Committee, which is in charge of tax revision bills.

Mr. Dan E. Bloxsom, President of Southwestern Plastics, Houston and Mr. Alfred Fukal, independent consultant of Houston, presented evidence on the difficulty of obtaining defense orders. The committee appointed a U. S. Navy procurement officer from the Panel to confer directly with Mr. Bloxsom.

The House Small Business Committee has been holding hearings in all the major U. S. cities in recent months, giving assistance similar to the above to businessmen throughout the country.

Central Ohio

(Continued from page 8)

14. "Wine, women, and song"—these are fine, Mr. Schor said, since editors are only human, but if you do not have a story to tell, no amount of entertainment will sell your release to a reputable industrial magazine.

15. Photographs that do not tell a story—flat picture of the face of the meter gives no information and adds no interest to the story.

16. Failure to discuss a "special" story with the editor. If the resulting editorial presentation is not to the liking of the manufacturer, or if his story does not get into print at all because it does not meet the requirements of that particular publication, he has only himself to blame because of not previously discussing the material with the editor.

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